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A COMPARISON OF VARIOUS TECHNIQUES FOR THE DISSEMINATION OF A NEW SCIENCE CURRICULUM IN FLORIDA.

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THREE APPROACHES TO INSERVICE TEACHER EDUCATION WERE EXAMINED TO DETERMINE WHICH WAS MOST EFFECTIVE IN PREPARING TEACHERS TO USE A NEW CURRICULUM IN SCIENCE. THE CURRICULUM, "SCIENCE - A PROCESS APPROACH," HAD BEEN DEVELOPED THROUGH EFFORTS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE FOR SCIENCE INSTRUCTION IN GRADES K-3. THE THREE METHODS OF TEACHER EDUCATION STUDIED WERE (1) A SUMMER INSTITUTE, (2) A YEAR-LONG INSERVICE COURSE, AND (3) SELF-INSTRUCTION THROUGH THE USE OF A TEACHER MANUAL. OF THE APPROXIMATELY 620 TEACHERS WHO RECEIVED INSTRUCTION IN THIS PROJECT, 90 WERE SELECTED AS SUBJECTS FOR STUDY, AND 30 ADDITIONAL TEACHERS WERE SELECTED FOR A CONTROL GROUP. THIS CONTROL GROUP DID NOT RECEIVE ANY INSERVICE TRAINING NOR TEACH THE "PROCESS APPROACH." EVALUATION WAS CARRIED OUT USING THREE TECHNIQUES--(1) TESTING A RANDOM SAMPLE OF STUDENTS IN THE CLASSES OF PARTICIPATING TEACHERS (FOUR STUDENTS IN EACH CLASS), (2) OBSERVING THE INTERACTIONS IN CLASSES OF PARTICIPATING TEACHERS, AND (3) USING A QUESTIONNAIRE TO ASSESS TEACHER ATTITUDES AND OPINIONS. THE INSTRUMENT USED TO TEST STUDENTS WAS DESIGNED TO MEASURE ACHIEVEMENT ON THE PROCESSES TAUGHT IN THE "PROCESS APPROACH" OF MEASURING, CLASSIFYING, COMMUNICATING, PREDICTING, USING SPACE-TIME RELATIONS, INFERRING, USING NUMBERS, AND OBSERVING. RESULTS FROM ALL EVALUATIONS INDICATED SUPERIORITY OF THE YEAR-LONG INSERVICE COURSE FOR TEACHER EDUCATION. STUDENTS OF TEACHERS IN THE INSERVICE COURSE GROUP ACHIEVED HIGHER ON OVERALL BASES AND REQUIRED LESS DIRECT TEACHER INTERVENTION FOR LEARNING. TEACHERS IN THIS GROUP WERE MORE WILLING TO EXPAND, MODIFY, AND APPLY THE NEW CURRICULUM MATERIALS. (JH)

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FINAL REPORT
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A COMPARISON OF VARIOUS TECHNIQUES FOR THE DISSEMINATION OF A NEW SCIENCE CURRICULUM IN FLORIDA

March 1967

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A Comparison of Various Techniques for the Dissemination of a New Science Curriculum in Florida

Project No. 5-0651-2-10-1
Contract No. OE-6-10-046

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Mr. James Pierce and Mrs. Ester Leedham taught in the Summer Institute, Mr. Harold Jaus served as instructional assistant and Miss Dorothy Schlitt as consultant observer. Mrs. Dorothy Webb was project secretary and administrative assistant in its early phases. Mrs. Linda Thompson carried out the duties of project secretary for the later phases, including the preparation of this report.

Credit for other activities in the project is given in the appendices of this report where the course instructors, participating teachers, and others who made specific contributions are listed. However, the junior college presidents, the school superintendents and principals, the science supervisors, and the many teachers and students who were instrumental in less specific ways in this project are not listed. Appreciation to them and to any person who might have been inadvertently overlooked in these pages is hereby expressed.

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Paul Westmeyer

I. INTRODUCTION

The project described in this report was conducted by the Department of Science Education of Florida State University during the period July 1, 1965, to March 31, 1967. During this period some 620 teachers were introduced to the AAAS, "Science - A Process Approach," materials. One hundred and twenty of these teachers and 3,600 children were directly involved in the experiments described in this report.

A. Problem and Background

The past several years have seen unprecedented attention given to educational reform. Curriculum development and revision and the invention of new teaching procedures, materials, and equipment are some of the end results of a strong emphasis on educational research and development. This emphasis has both contributed to and benefited from the information explosion characteristic of the past two decades. Educational innovation has also benefited from increased attention given it by the general public and by federal, state, and local governments. Federal involvement and Federal funding in particular have contributed to the major changes which have evolved in American education in recent years.

A problem inherent in the development and general application of an educational invention in schools at the national level is that of appropriately evaluating the innovation and broadcasting evaluation results to the total educational public. Another major problem involves the identification or more effective means for dissemination of educational innovations. The project herein reported was initiated in an effort to evaluate several potential techniques for wide-scale dissemination of a curriculum improvement effort and to assess their effectiveness in reaching large numbers of teachers.

Since 1956 much time, money, and effort has been expended to refurbish science teaching in the public schools. Some of these efforts have been aimed at improving the subject matter competency of teachers; others have focused on the development of new curricula and the subsequent orientation of science teachers to these curricula. Both kinds of activity have relied heavily upon Summer and In-Service Institute programs in order to accomplish the goals of informing and training teachers. The efficiency of these two techniques for educating large numbers of in-service teachers has never been thoroughly investigated.

Any additional large scale effort to disseminate new curricula through the medium of summer or in-service teacher training programs will be a costly enterprise. Techniques, therefore, need to be devised to predict the probabilities of success which might be expected from such efforts. A major objective of the project discussed here has been to provide a basis for making such predictions.

Several of the major curriculum improvement programs have developed teachers' guides designed to assist teachers in implementing the new programs without special in-service training. That this approach to implementation of new curricula is practicable has not been clearly established. Certainly if such an approach to in-service teacher education is valid, the need for special Institutes such as those just mentioned would require re-evaluation. A second objective of this project was to inquire into this possibility.

In the project herein described, three approaches to teacher training were employed for dissemination of a curriculum innovation: (1) Summer Institute training; (2) in-service course training; and (3) use of a specially designed teacher manual rather than any formal training. These three kinds of in-service methods were used for the introduction of a new curriculum in elementary school science. The particular science courses employed in the experiment were developed by a writing team representing the Commission on Science Education of the American Association for the Advancement of Science. The curriculum for grades K-3 is entitled "Science - A Process Approach."

The experiment was specifically designed to investigate the relative effectiveness of the three methods of teacher training on a large scale basis. In addition to the three principal treatment methods, a control was utilized. The control served as a base with which to compare the three instructional techniques in order to determine the effect each might have on teachers and thus, indirectly, on the science education of small children.

One hundred and twenty teachers and 3,600 children were involved in the actual experiment, and 400 additional teachers received in-service training as a result of the project. All teachers and children participating were from Florida schools.

The treatment groups included: (1) 30 first, second, and third grade teachers (ten at each grade level) who received an introduction to the course, "Science - A Process Approach," at a five-week Summer Institute held at Florida State University during the summer of 1965; (2) 30 first, second, and third grade teachers who participated in a similar instructional program offered through special in-service courses held throughout the state of Florida during the school year 1965-66. Participating teachers employed the new materials in their own classrooms concurrently with their participation in the instructional program; (3) 30 first, second, and third grade teachers who received instruction manuals designed to accompany "Science - A Process Approach" as well as the materials necessary to implement the new program, but who did not participate in the in-service or Summer Institute programs and did not communicate with the teachers who had had this experience.

The control group was composed of 30 first, second, and third grade teachers who did not use the "Process Approach" course and did not communicate with teachers using the materials.

The four groups described above are identified in the remainder of this report as "Treatment Group I" (Summer Institute), "Treatment Group II" (in-service courses), "Treatment Group III" (materials supplied but no training), and "Treatment Group IV" (control).

Evaluation of these in-service techniques focused on the outcomes of instruction and involved interpretation of the following types of information: (1) observations made in the classrooms of participating teachers and students by a trained team of observer-supervisors; (2) reactions of participating teachers to a questionnaire designed to assess their attitudes toward the new program and their judgments as to its effectiveness; and (3) scores on objective tests designed to measure progress in the new course which were administered to selected children in classes of participating teachers.

In addition to the specific objective of evaluating the effectiveness of the various training procedures, an additional goal of the project was the subjective evaluation of logistical problems concerned with the implementation and administration of the in-service efforts.

B. Review of Related Research

Since the purpose of this study was to investigate three different techniques for implementing AAAS "Science - A Process Approach" materials in selected elementary schools in Florida and to evaluate the relative efficiency of each technique, a review of several different areas of the literature seems pertinent as background for the study. Selected literature pertaining to the AAAS "Process Approach" is here surveyed. The need for studies involving communication to educators concerning innovations is obvious in view of the rapid development of new curricular materials. Miles [20] expresses this need. In-service efforts in this regard are also surveyed. Since the study utilized classroom observations as an evaluative tool, a review of interaction analysis is also included.

1. History of the AAAS Project

The Commission on Science Education of the American Association for the Advancement of Science has attempted to stimulate improvement of science education at all academic levels. Since 1962 one of the major activities of the Commission has been the preparation and evaluation of science materials for the elementary school grades. These materials consist of a series of exercises designed to improve the skills of children in using the processes of science. The development of the project is outlined in an article by Livermore [17].

In 1961 Dr. John R. Mayor directed a feasibility study in which scientists and leaders in education joined forces in three conferences held at Berkeley, St. Louis, and Washington. These participants agreed that there was an urgent need for new science materials in the elementary school and made suggestions concerning the nature of these materials.

The AAAS established the Commission on Science Education in May, 1962, to implement these recommendations. The Commission sponsored two eight-day conferences during the summer of 1962, one at Cornell University and one at the University of Wisconsin.

The work at these conferences was influenced by a paper on curriculum design presented by Dr. Robert Gagne [11] of the American Institute for Research in the Behavioral Sciences. From the conferences came two strong recommendations: (a) the Commission should sponsor the development of instructional materials beginning at the kindergarten level, and (b) materials should be developed to stress the processes of science in the early grades rather than to emphasize science content per se.

A working paper was prepared by Gagne [12] with the assistance of several collaborators. The process approach was elaborated in detail and the basic information and skills which a child might be expected to have acquired at each grade level were identified.

During the summer of 1963 a group of writers prepared 100 exercises which were printed in four parts for experimental use in the K-3 grades of twelve selected school systems in various parts of the country. During the following school year 106 tryout teachers and approximately 3,000 children were involved in the testing of the materials. This cycle of first developing and revising materials and then trying them out was repeated during the next two years. Extensive "feedback" from the tryout teachers has contributed to the present effectiveness of the program. Livermore presents a brief history of the AAAS project in two articles [17, 18]. The Grade Teacher devotes most of one issue to the new curriculum [29]. Cunningham also refers to the new course [6]. Two articles dealing with actual implementation of the new materials in classroom situations are those by Brakken [2], and Brakken and Fordyce [3].

The materials presently available for experimental use include the Third Edition of "Science - A Process Approach," teaching kits, competency measures for each of the exercises, and the science "Process Instrument." The "Commentary for Teachers" and "An Evaluation Model and Its Application" are also available for use in the in-service training of teachers. An instructor's manual is presently being prepared to serve as a guide for the organization and instruction of a series of in-service programs.

2. The Processes

Livermore [17] calls the processes the warp on which the woof of content is woven. Eight processes have been identified for the primary grades: measuring, classifying, communicating, predicting, using space/time relations, inferring, using numbers, and observing.

In the materials for grades four and five, the following integrated processes are used: formulating hypotheses, making operational definitions, controlling and manipulating variables, experimenting, interpreting data, and formulating models.

3. Evaluative Component

One of the unique contributions of the AAAS project has been concern with the theoretical framework upon which the evaluation design is built. Walbesser [33, 34] reported on the design and rationale in two articles. In brief, the curriculum developer specified the classes of reliable observable behaviors which could be expected to be acquired by individuals exposed to a particular set of instructional materials. Following this, measures were designed to: (a) determine whether these performances had been acquired, and (b) assess the degree to which these performances were generalizable to new situations. These measures were then administered to students who had used the new curriculum materials. Data from testing of this kind were used as an evaluation of curriculum effectiveness.

Three behavioral measures were developed to evaluate the performance of children. A group "Appraisal Instrument" is included at the end of each exercise. This instrument is constructed in such a way that each of the behavioral objectives of the exercise is measured by the Appraisal. The second instrument is the exercise "Checklist of Competencies." Each Checklist item is related to one or more of the objectives stated in the exercise. Each set of Checklist tasks is designed as an immediate follow-up measure to be administered to individual students. The third type of instrument, the science "Process Instrument," is used to appraise the long range skill development of an individual within each of the processes. A shortened and revised version of this instrument was employed for part of the evaluation in the research project herein reported.

4. Achievement Studies

Much has been written about the need for improvement of science education. Piltz [24] felt that his findings "clearly reveal that the entire educational program is in need of reconstruction in light of present day needs of boys and girls living in a democratic society."

Stollberg [30] writes that although the principle of learning science through "doing" is almost universally accepted, it is by no means universally practiced. Many elementary school teachers, if they teach science at all, confine instruction to reading in a text.

Many writers have suggested reasons for the lag in the elementary school science program. Thurber [31] claims that the lack of self-confidence of classroom teachers is probably the greatest handicap. Others have indicated that disagreement on content or procedures has hindered science programs. For example, Hibbs [15] feels that enthusiasm for learning, rather than simple memorization of facts, should be an important outcome of elementary instruction in science. Victor [32] found that 79.7 per cent of the teachers in his research sample felt that it is more important for children to learn basic science information than to learn to think critically.

Gagne [13] says that the student should be provided with opportunities to carry out inductive thinking, to make hypotheses, and to test them in a great variety of situations. Navarra [21] urges that science projects and "research" by young children are keys to instruction. Butts [5] offers a formula: experience plus independence in manipulation plus direction depending on cognitive maturity equals conceptual understanding.

While many writers discussed the AAAS project, no studies outside of AAAS Pilot School studies have been published involving achievement of students using the materials. Possibly the difficulty of finding a valid instrument suitable for measuring achievement of two different approaches has forestalled some experiments.

In studies measuring differences in science teaching, the summarizing conclusions usually indicate that good teachers are effective regardless of classroom organization [Porter, 26]. "In the final analysis it is the classroom teacher who insures purpose in the science activity and sees that the activity leads into other avenues of learning" [Piltz, 25].

These ideas point up the need for well organized and somewhat directive materials to support teachers who have found it difficult to initiate an effective program in science.

The AAAS has tried to do just this with the new materials, but Newport [22] voices concern that the teachers using AAAS materials are expected to collect an unreasonable number of items for classroom participation. If his sample could be considered typical, a classroom teacher would need to assemble over 5,000 items for the sixty-three lessons of Parts 1, 2, and 3. Although the articles are fairly easy to obtain, teacher time, effort, and money involved could lead to the failure of the project, in his opinion.

5. In-Service Training Programs

Much of the literature involving the use of in-service courses to introduce a new curriculum contains ideas similar to those in an article by Rubin [27] in which he discusses the need for and the advantages of well organized in-service institutes. Other writers, such as Herman [14], simply describe in-service courses used to introduce a new curriculum in a particular school system.

By far the most common type of study related to in-service training programs is the opinion survey. Studies by Brittain [4], Houston [16], Metzgar [19], and Ostlund [23] are representative of this type. These studies generally indicate that, in the opinion of the participants and the principals or supervisors under whom they work, practically all training programs have been successful and the work of the participants has improved as a result of the program.

Several studies have attempted to evaluate training programs in a more objective manner. These evaluative efforts have generally been based on gain scores on an achievement test taken either by course participants or by their students [10]. Lack of adequate controls and difficulties in comparing those who chose to participate in the course with those who did not participate make results questionable. A particular weakness of such studies has been the criterion measure. In one investigation, Bingham [1] reports on the evaluation of an in-service program which extended over two years. At the end of the program (but not at the beginning) he gave the Sequential Tests of Educational Progress (STEP) and the Test on Understanding Science (TOUS) to a group of twenty teachers who had participated and twenty who had not. The teachers had been matched on several variables such as credit hours in science, years of teaching experience, grades taught, and professional certification. He found that the teachers who had participated in the program scored significantly higher on both tests. The STEP test was administered to a random sample of students under these teachers and it was again found that the students whose teachers had participated in the in-service program scored significantly higher than those whose teachers had not.

No attempt was made in any of the studies cited to compare types of in-service experiences. However, Ruddell and Brown [28] made such a comparison of three approaches to in-service training in arithmetic. This study suggests that one method of presentation may be better in some respects than others, but no clear cut best method was established.

Fischler [7] reports on a pilot study involving a unique in-service program. Four workshops were held during which SCIS materials were introduced. The methodology used and taught was the "discovery" approach.

6. Interaction Analysis

There is a number of category systems for analyzing verbal interaction in the classroom. However, the term "interaction analysis" most often refers to the system developed by Ned Flanders [8].

The Flanders system of interaction analysis was developed to provide a means of analyzing the verbal interaction between teachers and students. The Flanders system combines seven categories of teacher behavior with two categories of pupil responses. The classroom observer uses the Flanders system of interaction analysis to classify the statements of the pupils and the teacher into one of ten categories. The first seven categories involve teacher talking and include: (1) accepting student feeling, (2) giving praise, (3) accepting, clarifying or making use of the ideas of a student, (4) asking a question, (5) lecturing, giving facts or opinions, (6) giving directions, and (7) giving criticism. The two categories used when students are talking are: (8) student response, and (9) student initiation. The tenth category denotes silence or confusion. An observer using this system keeps track of the type of interaction and the time spent in different classroom activities. At the end of an hour's observation it is possible to add up the time spent in each of the activities and to combine them into a grand total for the entire hour.

The interaction analysis makes possible an appraisal of teacher behavior. That is, the analysis differentiates between indirect and direct influence. Indirect influence is defined as actions taken by the teacher which encourage and support student participation. Indirect influence would include those teacher statements falling into categories (1), (2), (3), and (4) of the Flanders system. Direct influence refers to restricting student participation. Direct influence may be gauged by noting those teacher statements falling into categories (5), (6), and (7). A ratio called the I/D Ratio can be established for each teacher on the basis of the number of indirect influence statements divided by the number of direct influence statements. Flanders also suggested an alternative to the I/D Ratio. This new ratio could never have a zero denominator. This ratio uses the indirect categories for the denominator. This I/(I + D) ratio is used in the treatment of the data given later in this report.

Flanders presented several generalizations which were concerned with patterns of teacher influence and which had been established by a number of researchers. These generalizations consisted of a summary of the research completed by 1958. Among these generalizations were the following:

> (1) there is a direct relationship between teacher influence that encourages student participation and constructive pupil attitudes toward the teacher, the schoolwork, and the classroom activities;
>
> (2) the patterns of influence used by teachers are affected by: (a) the subject matter being taught, (b) the age and maturity of the students, (c) the instructor's preferred style of teaching, and (d) the nature of the learning activity;
>
> (3) all teachers employ a combination of statements, some of which restrict freedom of participation and others that expand freedom of participation. A fairly stable proportion or balance of indirect and direct statements can be identified for each teacher over an extended period of observation. This ratio, the I/D Ratio, is positively correlated with the class average on an attitude inventory.

The eight year research program directed by Flanders involved the development of interaction analysis as a tool for quantifying patterns of teacher influence. One of the first uses of this research tool was in a study conducted in urban schools of both Minnesota and New Zealand. It was found that an above average pattern of indirect teacher influence was associated with above average scores on a student attitude inventory. Work by Flanders also indicates a relationship between the behavior of the teacher and the achievement of the students. Two different groups of teachers were observed. Sixteen teachers were selected from a population of teachers of seventh grade combined English-social studies classes. The second group of sixteen teachers was selected from the population teaching eighth grade mathematics. Both groups were provided with instructional materials for two weeks of work. For both groups, pre- and post-test designs were used to measure achievement. Each teacher was observed six times by an observer using the Flanders system of interaction analysis. The results of the study indicated that, in classrooms in which the teacher was more indirect, both attitudes and achievement scores of the students were superior. The gain in achievement of classes taught by indirect teachers was found, by the method of analysis of covariance for initial differences in student ability, to be significantly greater than the gain of classes taught by direct teachers.

The tool of interaction analysis was also put to use in an in-service training project [9]. In this study secondary school teachers were trained to collect interaction analysis data. Time was provided in which they could experiment with different teaching methods with an observer present. Significant progress was made by teachers in developing more flexible and indirect patterns in their own behavior. This study has important implications for pre-service teacher preparation.

C. Objectives and Hypotheses

Specific objectives of the study were: (1) to evaluate the effectiveness of three different procedures for acquainting teachers with the philosophy and methods of a new curriculum in terms of teacher opinion, observer reaction, and student achievement, and (2) to identify and report logistical problems involved in the organization of a statewide, or other large-scale, program for dissemination of a new curriculum. A peripheral objective was to evaluate the effectiveness of a specific new science curriculum at the elementary school level.

The major null hypotheses to be tested were: (1) after one year of instruction there are no differences among the average process capabilities of each of the three experimental groups of elementary school children at specified grade levels as measured by an objective process capability measure; (2) after one year of instruction elementary children from each of these experimental groups, each using "Science - A Process Approach" as the major instructional device, do not differ from children in an untreated control group with respect to process capability as measured by an objective process capability measure.

Additional questions which were investigated included the following: (1) did teacher opinion concerning the various dissemination techniques for the new course differ depending on the method of instruction to which each teacher was subjected? (2) did observer opinion concerning the kinds of activities taking place in classrooms of participating teachers exposed to different types of in-service training for the new course indicate interpretable differences? (3) were the techniques employed for implementation of the project on a broad scale administratively feasible?

II. METHOD

In order to carry out the project described in this report, several of the necessary administrative steps were initiated prior to the actual awarding of Federal funds by the Office of Education. Initial planning and operation were carried out with University support and with funds made available through the National Defense Education Act, Special Projects Office, a special state funding agency in Florida.

The project originated during the fall of 1964 when discussions between various members of the Department of Science Education of the Florida State University and officials from the State Department of Education in Florida revealed the need for upgrading the teaching of science at the elementary school level in this state. After considerable discussion it was decided that the first positive step toward improving the situation would be to examine available new curriculum materials, to make a decision as to which materials might be most appropriate for schools in the state of Florida, and then to devise means by which these materials might be made available to teachers. Since teacher in-service education seemed to be a primary need in such an effort, a proposal was developed and submitted to the Office of Education to carry out the experimental project described in this report. A second proposal to implement initial steps in the project, including such activities as conducting informational conferences, was developed and submitted to the NDEA, Special Projects Office. This proposal was funded. A complete report of this special project is included in the appendix of this report. Plans were developed to set up a large number of in-service courses around the state and, in addition, provisions were made to conduct the Summer Institute and Workshop described later in this section.

Since a large scale in-service project was planned, it was immediately recognized that the Department of Science Education at Florida State University could not supply the necessary instructors to staff the number of institutes which appeared to be needed. Other sources of prospective instructors were sought. In January, 1965, a meeting was held with presidents of all the junior colleges in the state of Florida. Plans for a large-scale in-service education effort were discussed and the cooperation of these administrators was solicited. They were asked to nominate appropriate instructors from their own staffs. It was anticipated that these instructors might work in the planned program on a part-time or extra time basis. The proposal was given unanimous support by the junior college presidents.

Another task was to select those science materials which would be disseminated in the program. This was accomplished in early February by a committee composed of State Department of Education representatives and Department of Science Education personnel after a survey of available materials had been made. It was determined that the materials most appropriate for the schools in Florida were those produced by the Commission on Science Education of the American Association for the Advancement of Science. The course, entitled "Science - A Process Approach," was considered to incorporate an approach and philosophy compatible with the long term K-12 science program envisioned in Florida, major emphasis on student activity rather than on verbal exchange between student and teacher. The course necessitates the utilization of considerable teaching equipment and allows children the opportunity for elementary laboratory work at an early stage in their educational experiences. The course, as the name suggests, stresses the processes or basic skills involved in understanding the scientific disciplines rather than subject matter per se.

Following the decision to employ the AAAS materials in the dissemination project, negotiations were undertaken with the AAAS Commission on Science Education to obtain use of the materials which were not at the time available for use by the general public. Working with Dr. John Mayor, Director of Education for AAAS, a satisfactory arrangement for implementation of the materials was negotiated. It was agreed that Florida could utilize the course for an unlimited number of classes at grades 1, 2, and 3. (Materials were also released for the use of kindergarten classes although there were very few of these in Florida.) Equipment was to be obtained from the suppliers who had worked with the AAAS Tryout Centers, but financial and supply arrangements were to be independent of those set up for the AAAS Curriculum Development Project Tryout Centers.

The next major step in implementing the project was to inform school administrators, curriculum supervisors, and other appropriate individuals of the proposed program. This was accomplished by means of a series of conferences held throughout the state during February and March, 1965. Permission to conduct the meetings was obtained from the State Superintendent and a written statement regarding his cooperation was sent to each county superintendent. Arrangements for meetings were made by personnel designated by county superintendents working with local junior college presidents where possible. Representatives from Florida State University conducted the meetings at twenty-one different locations in Florida. Meetings were scheduled principally for superintendents, principals, and supervisors although teachers attended when this was feasible. Approximately 90 per cent of the school administrators in Florida attended one or more of the meetings. In addition a large number of teachers and parents was able to learn about the proposed project by this means.

Each meeting had somewhat the same format. A demonstration of some of the activities to be included in the proposed new elementary science course was first presented to the group. In many instances meeting participants were given an opportunity to perform some of the experiments or to role-play and thus take an active part in the meeting. Questions concerning the course were answered. Than a plan for large-scale in-service education and course dissemination was described.

It was pointed out that the great majority of teachers taking part in the project would, at their own expense, attend one of a series of in-service courses to be held at locations throughout the state during the school year 1965-66. Each institute would be located centrally for teachers in a particular county or area and would be taught by one of a core of adjunct professors trained, certified, and assigned by Florida State University. A new course, Science Education 509, "Innovations in Elementary School Science," was to be designed as the vehicle by which the in-service training program would be conducted. It was announced that each teacher would be expected to pay tuition for participation in this course unless the local school system could meet this expense. Tuition for the two semester sequence was set at $84.00, with six hours of graduate credit extended for successful completion. Teachers were not given the option of taking the course for a single semester only. In addition to the tuition expenses, it was required that teachers have in their possession the necessary equipment and materials for teaching the course as well as the Teacher's Guides designed as an aid for this course. It was suggested that teachers be expected to pay for their own Guides as a textbook for the institute at a cost of $10.00, with the local school system providing equipment and materials at the cost of approximately $180.00 per classroom. In a few instances local school systems or counties provided either tuition or books or both but this was not the typical situation.

As a result of the state-wide informational meetings and the follow-up done orally by school administrators, approximately 1,000 classroom teachers submitted forms indicating an interest in participating in the program. Each of these teachers also obtained a signed statement from the principal in the building in which he or she taught indicating local administrative support and agreement to try out the new materials. On the basis of these expressions of interest, plans were made tentatively to conduct twenty-five in-service courses at appropriate locations throughout the state during the school year 1965-66.

The next phase of the operation involved the planning of two different institutes which were to be held on the campus of the Florida State University during the summer of 1965. By this time, early April, the Office of Education had conducted a site visit with the project directors and had indicated a positive position with regard to the research proposal which had been submitted. On the basis of this anticipated support, thirty teachers were selected at random from the 1,000 who had indicated interest in the program. These teachers were informed that they would receive instruction during a special institute to be held for five weeks during the summer of 1965. The institute took place from June 22 to July 23. These teachers were awarded tuition waivers and free books. Materials were supplied for use in their classrooms. In addition, each teacher received a stipend equivalent to that typically paid to participants in National Science Foundation Summer Institutes, $75.00 per participant, $15.00 per dependent to a maximum of four, and round trip transportation to the University.

A second institute, actually termed a Workshop, was organized to train prospective instructors of the several sections of the in-service course which was to be held in the state during the school year 1965-66. From approximately 75 applications of prospective in-service course instructors, 25 participants were selected for attendance at a five week Workshop which was to be conducted concurrently with the Summer Institute for elementary school teachers. For participation in the Workshop, potential adjunct professors were to receive stipends of $75.00 each, plus $15.00 per dependent and round trip transportation. In addition, they were supplied with complete kits of materials for grades 1-3 of the AAAS course. University tuition was also waived so that they might be awarded credit for the new course which they were eventually to teach.

At approximately the same time, consultants were called to Tallahassee to plan the new course, Science Education 509. The planning session involved representatives from the AAAS writing team who had designed the "Process Approach" as well as faculty personnel from the Department of Science Education of Florida State University. Somewhat different kinds of activities were scheduled for Workshop participants than for Summer Institute participants, although provision was made for both groups to meet together when consultants and guest lecturers would be available. An outline for the in-service course to be offered during the following school year was also worked out.

Another project activity accomplished at about this same time was the negotiation with suppliers to provide equipment and materials both for the summer program and for the activities which would go on during the school year 1965-66. This involved soliciting a commitment from the major supplier to develop 600 kits for grade levels kindergarten, 1, 2, and 3 on the basis of a preliminary survey of probable participants. These kits were to be similar but not identical to those which the AAAS curriculum development team had used in the tryout centers. Some items were deleted in the kit that was provided in the Florida project and some substitutions in equipment were also made because of cost considerations. Since there was over $100,000 worth of equipment involved, most of it to be purchased by local school systems, the supplier had to make a considerable commitment on faith that the project would actually evolve as planned. The equipment supply problem was critical to the potential success of the project. These equipment negotiations were carried on in Chicago by representatives from Florida State University and the supplier.

Concurrently some revisions were made in the proposal submitted to the Office of Education. Revisions were initiated as a result of the site visit conducted by representatives of the Office of Education. The meeting between USOE representatives and the project planners took place in February, 1965. In June, 1965, formal approval to conduct this project was obtained from the Office of Education.

The Summer Institute and the Workshop were held. Thirty classroom teachers met daily for five weeks on the second floor of the Geology Building while twenty-five college instructors, science consultants, secondary school science teachers, and administrators who were to serve as in-service instructors during the school year 1965-66 met in another room on the first floor of the Geology Building. When consultants were on campus in conjunction with the project, as was the case several times during the summer, both groups were brought together. During the Institute and the Workshop, participants were introduced to all the activities included in the "Process Approach" course for grades kindergarten through three. They carried out each laboratory exercise and, in addition, worked with children at the University School, observing their reactions to the new course. Role-playing among the groups was stressed so that each participant taught others in his group. On occasion, exchanges were made among participants in the two programs so that prospective in-service instructors could note the reaction of elementary teachers to certain kinds of activities and the elementary teachers could in turn verbalize their opinions concerning teaching approaches used by the prospective instructors.

After completion of the Summer Institute, classroom teachers went back to their respective schools throughout the state and introduced the new approach using the materials that had been made available to them. Twenty-one of the twenty-five participating in-service instructors were selected for the twenty-one in-service courses actually conducted. Courses were scheduled at Belle Glade, Bradenton, Clearwater, Cocoa, Gainesville, Hialeah, Jacksonville, Lake Wales, Lake Worth, Leesburg, Melbourne, Miami (2), Naples, Orlando, Pensacola, Punta Gorda, Sarasota (2), St. Petersburg, and Tampa. Five hundred and twenty elementary teachers registered for these courses.

From the total enrollment of 520 teachers, thirty were selected at random to participate in the experimental phase of the project. With only twenty-one institutes, not all of the teachers who had initially expressed interest in the project could participate. Thirty of those who had not been selected for the in-service courses were selected at random and given materials for introducing the "Process Approach." In addition, they were given the special instructional manuals which had been developed to accompany the new materials. They were, however, not provided any formal instruction and they were so located that they could not be in contact with teachers who were involved in the formal in-service instructional activities. These teachers represented the "materials-only" group, Treatment Group III.

Thirty other teachers who had indicated interest in the in-service course were selected for the control. They were not given any of the materials for the "Process Approach," and they were not given the opportunity to participate in an in-service course. They were selected so that they would not be in contact with other teachers who were participating in the experiment.

By the beginning of the 1965-66 school year, then, the following four experimental groups had been established: (1) teachers who had been oriented to the "Process Approach" during a Summer Institute and were then introducing it in their own classrooms; (2) teachers enrolled in in-service courses who were introducing the "Process Approach" concurrently in their own classrooms (typically in-service course instructors stayed two weeks ahead of the teachers who were then prepared to teach the new course the same year that they learned about it); (3) teachers in the materials-only group who were introducing the new course in their classrooms but who had not had formal instruction in it (they were provided the help of a specially designed teachers' manual); and (4) the control group who did not use the new course.

Each of the twenty-one in-service courses began in September, meeting once a week for three hours, typically in the evening or in some cases late in the afternoon after school. Each course was taught by an adjunct professor who had received training during the summer Workshop at Florida State and who had subsequently been certified by the University. Additionally, an assistant instructor was assigned in each course. The assistant did not receive any formal training for introducing the AAAS materials but rather learned with the teachers and assisted the instructor in various ways. Typically, this was a teacher with a good science background or an administrator in the area. In many cases either the county elementary supervisor or the county science supervisor in the area where the course met acted as the assistant. A few elementary school principals also served in this capacity. The names and positions of all instructors and assistant instructors are included in the appendix of this report.

Supervision of the in-service courses was carried out by the project staff. At least three classroom visits were made to each area during the thirty weeks of in-service instruction. The project director made at least two of the visits to each area while other members of the Department of Science Education staff made the other visits. During these visits, problems were discussed, questions were answered, and background information on the project was made available.

In early September the equipment companies sent materials to each in-service center for distribution to teachers. There were some delays in delivery of equipment and teachers' manuals at the beginning of the school year but by the first of October most of these problems had been eliminated. Equipment proved to be somewhat of a problem throughout the year and materials for some activities were not satisfactory at all. One major contribution of the project was the feedback provided to equipment suppliers and curriculum developers. This feedback made it possible for many items to be improved and for the number of pieces supplied in each kit to be better evaluated. Early in the school year it was observed that teachers would have to spend a good deal of time assembling certain materials which were not included in the basic equipment kits. This became one of the major areas of work in the in-service courses. It was agreed before instruction in Science Education 509 began that emphasis would be placed on the activities and on preparing teachers for teaching rather than on tests, term papers, and other traditional course activities.

A major concern of the prospective in-service instructors during the last two weeks of the summer Workshop had been to plan their prospective course presentations. In general they planned about one hour of subject matter presentation for each course meeting on topics meaningful to teachers who would be using the "Process Approach." It was hoped that, during the course of the thirty weeks of instruction, a large amount of subject matter could be covered which would help elementary teachers improve in their general teaching performance in science. Other course activities included role playing, laboratory practice, discussion, demonstration, and teaching practice.

Early in the 1965-66 program, elementary students from the 120 classrooms identified for the three experimental groups and the control were tested with an aptitude battery. The Metropolitan Reading Readiness Test was used with first graders, and second and third grade students were tested with the California Test of Mental Maturity, Short Form.

In addition to the course supervision provided by the Florida State University staff, a group of supervisor-observers from around the state was identified and assigned to the project. Typically, these individuals were supervisory personnel from counties in which the in-service courses were held. As it turned out, only twelve of the twenty-one courses which were conducted actually provided teacher participants for the in-service experimental group. The other nine were held in areas where it was not convenient to provide the additional supervision or where no participants were chosen by random sampling. The supervisory team held a meeting in Clearwater, Florida, during January, 1966. At this meeting supervisors were trained in the use of a special checklist device with which they would make somewhat subjective evaluations concerning the kinds of activities going on in the classrooms of teachers in the experimental groups. This device was adapted from one developed by Flanders for use in the technique known as interaction analysis. The original technique involved analysis concerning primarily the kinds of verbal interchange in the classroom. For the revised instrument an augmented set of Flanders categories was developed to meet the special challenges of observing classes of elementary school science. The fifteen categories of the Classroom Activity Analysis are as follows.

(1) Teacher Directions: instructs the student regarding appropriate procedures to be followed in performing a task or accomplish some specific objective.

(2) Teacher Lecture-Explanation: presents the student with a set of facts of specific information or clarifies a point of discussion.

(3) Teacher Question: initiates an interrogation of the student in such a fashion as to require a specific response on the part of the student which reflects the student's knowledge of content.

(4) Student Response: response to a specific content question from the teacher.

(5) Student Qeustion: requests clarification or more information regarding some specific content area.

(6) Teacher Response: responds to a student's verbalization relevant to content.

(7) Student Initiated Ideas: initiates new concepts which originate from the problems or discussion currently relevent to the content under consideration.

(8) Student Blackboard Activity: one or more students involved in blackboard activity which requires the attention of the entire class.

(9) Student Problem Activity: all members of the class actively involved in laboratory exercises or other problem solving activities which do not require verbalization.

(10) Part-Student Activity (non-productive activity on the part of the remainder of class): a subset of the class involved in a relevant content activity with the rest of the class devoid of planned constructive work.

(11) Part-Student Activity (balance of class involved in productive activity): a subset of the class actively involved in relevant content activities with the balance of the class constructively involved in planned activities.

(12) Teacher Praise: sincere and relevant praise on the part of the teacher for meritorious work on the part of the student, does not include reflex type responses involving routine "good" or "right" after student responses.

(13) Teacher Criticism: expression of disapproval of student behavior either as a group or on an individual basis.

(14) Non-Productive Activity: activity not contributing to the acquisition of information or learning about content.

(15) Seatwork or Other Pupil Activities: other than those suggested in the manual of activities for the AAAS "Process Approach."

Each observer made at least two observation visits to each classroom of teachers in the experimental and control groups in his area during the period February through May, 1966. These observations were designed to allow a more objective evaluation concerning the kinds of activities going on in the classrooms.

A second evaluation technique was used late in the school year. It involved the distribution of a questionnaire to each participating teacher. This questionnaire focused on a number of issues - science facilities in the schools, kinds of material initially available, evaluation of materials made available through the AAAS project, and course instructors.

In May, near the end of the school year 1965-66, a test developed by the AAAS Commission on Science Education, the "Process Instrument," was administered to selected children from classes of participating teachers. Four children, two boys and two girls, were selected at random from each of the 120 participating classes. (Since the test required individual administration and since considerable testing time was involved, it was determined that not all children in the AAAS classes could be tested.) There was no opportunity to follow a pre- and post-test design for two major reasons: (1) the length of time required to administer the test and the resultant administrative expense, and (2) the unique nature of the test which would have made a pretest relatively meaningless. Students in the control group were also tested.

The "Process Instrument" involved eight separate tests measuring competency in each of eight processes identified as being developed in this course. The eight processes were measuring, classifying, communicating, predicting, using space/time relations, inferring, using numbers, and observing. Each test was set up on a hierarchical basis to measure the degree to which skills had been acquired on an ascending order of difficulty or process structure.

In preparation for administering the tests, seven meetings were held throughout the state specifically to train testers. The test was necessarily administered individually, somewhat in the nature of the Stanford-Binet individual battery, and training was considered absolutely essential for the testers. Each training meeting lasted one day and was conducted by the project staff, who had previously been trained in the administration of the test. Testers were selected from among available personnel in the in-service course areas, typically substitute teachers, supervisors, or, in a few cases, lay citizens.

The testing phase of the operation completed the evaluation. Instruction in the in-service courses was completed in May and classroom instruction ended in June, essentially completing the project except for analysis of data collected and preparation of the final report. It is interesting, however, to note that the in-service course operation and implementation of "Process Approach" materials has continued and even accelerated to some degree. During the 1966-67 school year, twenty-two courses were underway with 619 teacher participants. In addition, many Florida counties have initiated local non-credit in-service programs with third order instruction utilizing teachers who have completed the FSU program and have had a year of experience with the new elementary science materials. Several Florida counties, including Dade (Miami), Escambia (Pensacola), Brevard (Cocoa), and Sarasota (Sarasota), have decided to use the new materials as their total primary grade science program throughout the system.

III. RESULTS

Three kinds of data were collected in this study: (1) student test scores on the "Process Instrument," (2) observer data on classroom interactions, and (3) results of teacher questionnaires completed at the end of the 1965-66 school year. These data are here presented in three separate sections.

A. Student Test Data

1. Collection

All students from classrooms of the 120 teachers cooperating in the evaluative part of the experiment were tested during the fall, 1965, in order to establish base line data. First grade students were given the Metropolitan Reading Readiness Test and second and third grade students were given the short form of the California Test of Mental Maturity. Total scores on the former and I.Q. scores on the latter were used as basic data.

After establishing lower score limits below which students were not included, two boys and two girls were randomly selected from each participating class for the individual testing program. Table 1 reports mean scores on the base tests of the selected students from each Treatment Group.

During the latter part of May, 1966, these students were tested with the "Process Instrument."

In order to achieve comparable and meaningful test results and to insure that the results would form a valid basis for evaluating the total program, explicit directions for test administration and scoring were prepared. Standard conditions were to apply in regard to materials used, directions and questions addressed to the student, manner in which the materials were presented, method of deciding whether a response was acceptable or unacceptable, time and method of recording scores, and the assistance the tester was allowed to give the student. All of these procedures were outlined in detail for the testers. (More detailed information may be found on the direction sheet given to each tester. See Appendix J.)

Each of the eight tests consisted of a different number of questions. Different numbers of questions were administered in different grades. In the Communication test, for example, the first grade students were asked the first eight questions, second grade students the first twelve, and the third grade students all fourteen questions. First graders were not tested on Inference or Prediction.

First Grade

	Treatment Group			
	I (N = 36)	II (N = 36)	III (N = 24)	IV (N = 39)
Metropolitan Reading Readiness Total Score	52.69	53.33	55.46	53.97

Second Grade

	Treatment Group			
	I (N = 36)	II (N = 40)	III (N = 36)	IV (N = 40)
California Test of Mental Maturity I.Q. Score	106.42	110.50	107.69	108.85

Third Grade

	Treatment Group			
	I (N = 36)	II (N = 39)	III (N = 28)	IV (N = 39)
California Test of Mental Maturity I.Q. Score	107.03	109.49	110.25	110.38

Table 1.
Mean Scores on General Ability Measures for Children
Who were Selected for Achievement Testing
from the Four Treatment Groups

Each tester administered only two of the eight tests. Thus one tester administered Measurement and Classification, another Communication and Prediction, a third Space/Time and Inference, and a fourth Numbers and Observation. The results were entered on IBM data sheets and returned to the project office.

A student received a 1 for every correct response and a 0 for every incorrect response. After four consecutive incorrect responses, no further questions were asked from the particular test. The correct responses were then totaled.

Cards were punched for each student showing his score on each test. The students were divided according to grade within each Treatment Group. The scores on each of the eight tests were analyzed in each of the above divisions. The mean and standard deviation for each test for each grade in each Treatment Group were determined.

2. Analysis

An analysis of variance was made of the ability test scores for all students at each grade level. None of the F values was found to be significant. Thus it was possible to accept the hypothesis that the students in all four Treatment Groups at each grade level were from the same population.

An analysis of variance was then made of scores on each of the eight parts of the "Process Instrument" among Treatment Groups for a sample of students at each grade level.

The mean scores used in the over-all analysis of variance are shown for each grade separately in Tables 2, 3, and 4. Those processes for which analysis indicated a between-groups difference significant at the .01 level are marked with a single asterisk (*); differences significant at the .05 level are marked with a double asterisk (**). The process numbers in Tables 2, 3, and 4, and subsequently in this report, refer to measurement (1), classification (2), communication (3), prediction (4), use of space/time relations (5), inference (6), using numbers (7), and observation (8).

In the five instances where a significant F value was found, successive analyses of variance were made on combinations of the four Treatment Groups. The significant comparisons shown in Table 5 were thus found.

B. Classroom Interaction Data

1. Collection

Another of the evaluative measures employed in this study was a series of teacher observations made by a specially

First Grade

Process	Treatment Group I (N = 36)	 II (N = 36)	 III (N = 24)	 IV (N = 39)
1	8.06	8.39	9.33	6.64
2	2.42	2.89	3.04	2.59
3	2.97	3.28	3.33	3.26
4	(No Test)	----	----	----
5*	11.81	12.53	9.54	7.18
6	(No Test)	----	----	----
7	4.86	5.03	6.29	5.51
8	7.78	9.31	9.38	9.36
Ability Score	52.69	53.33	55.46	53.97

Table 2.
Means of Treatment Groups, First Grade

Second Grade

Process	Treatment Group I (N = 36)	 II (N = 40)	 III (N = 36)	 IV (N = 40)
1	11.72	10.42	9.92	8.77
2*	3.72	2.52	3.58	2.52
3*	3.58	5.05	3.33	4.45
4*	1.42	2.85	1.47	2.57
5	9.97	12.35	8.31	11.42
6	2.56	2.65	2.94	2.32
7	8.89	7.42	6.53	7.17
8	11.47	10.05	9.81	9.45
Ability Score	106.42	110.50	107.69	108.85

Table 3.
Means of Treatment Groups, Second Grade

Third Grade

	Treatment Group			
Process	I (N = 36)	II (N = 39)	III (N = 28)	IV (N = 39)
1	12.86	11.97	12.86	11.62
2	3.97	3.77	3.89	3.28
3**	5.36	6.26	6.61	4.77
4	2.97	4.00	3.75	2.92
5	12.03	15.46	14.25	12.33
6	4.86	5.28	4.29	4.90
7	9.36	10.31	8.93	9.36
8	11.53	12.64	11.93	11.00
Ability Score	107.03	109.49	110.25	110.38

Table 4.
Means of Treatment Groups, Third Grade

Grade	Process	Significant (.05 or .01) Comparisons
1	5 (space/time)	I > IV, II > IV, III > IV
2	2 (classification)	I > II, I > IV, III > II, III > IV
	3 (communication)	II > I, II > III, IV > I, IV > III
	4 (prediction)	II > I, II > III, IV > I, IV > III
3	3 (communication)	I > IV, II > IV, III > IV

Table 5.
Significant Comparisons Among Treatment Groups

trained team of observers. Each teacher in the experimental and control groups was visited twice by a member of an observation team. The same observer was assigned to make both visits to the classroom of a particular participating teacher. Observation vivits were made during the period, March, 1966, to May, 1966.

Observers were selected as described earlier in this report. Before making the classroom observations, each observer received practice in the use of the checklist with two "dry run" observations in elementary classrooms. As described earlier, the activity checklist consists of fifteen activity categories. The observer records a number representing the particular kind of activity going on at the moment at four second intervals for a thirty minute period. After an observation is completed, the observer tallies the results of his observations on a 15 x 15 matrix. Continuity of activities as well as activity transitions are analyzable by direct observation as well as by a variety of statistical methods. Objectivity of observations depends on the extent to which category definitions are distinct and commonly understood by different individuals making the observations. It is the opinion of the project staff that observer reliability was very good in this study due to the special instruction and preparation of the observation team.

For data analysis, individual matrices were combined within the grade levels and Treatment Groups so that only total Treatment Group observation results were considered. Due to administrative difficulties, observation data was not obtained for all teachers in the experimental and control groups. For example, of the thirty teachers originally assigned to Treatment Group I (Summer Institute training), data was available for only eight first grade teachers, nine second grade teachers, and eight third grade teachers. Data was obtained for seven first grade teachers, ten second grade teachers, and eight third grade teachers of the original thirty assigned to Treatment Group II (in-service training). In Treatment Group III (no training, materials provided), observation data was available for six first grade teachers, seven second grade teachers, and seven third grade teachers of an original thirty. Control teacher data (Treatment Group IV) was complete for eight first grade, nine second grade, and ten third grade teachers out of a possible thirty. Major loss of data from this particular phase of the evaluation was caused by problems with two supervisors. One failed to carry out her function at all and missed visiting all teachers to whom she has been assigned. Since this observer happened to have a number of Treatment Group III teachers assigned to her, this explains the relatively large loss of data on this Group. A second supervisor made only a portion of the observation visits which he had been assigned. This explains the rest of the data loss.

	Treatment Groups			
Categories	I	II	III	IV
1 (Teacher Directions)	11.9	10.3	13.2	7.9
2 (Teacher Lecture-Explanation)	9.1	10.4	10.5	15.8
3 (Teacher Question)	15.8	17.6	17.8	20.5
4 (Student Response)	16.3	18.8	16.9	24.4
5 (Student Question)	1.2	1.2	.6	.7
6 (Teacher Response)	3.5	3.6	3.3	3.7
7 (Student Initiated Ideas)	1.4	1.7	2.0	3.7
8 (Student Blackboard Activity)	5.4	4.9	3.1	1.3
9 (Student Problem Activity)	17.1	16.7	14.1	6.5
10 (Part-Student Activity - 1)	1.7	2.3	1.9	3.2
11 (Part-Student Activity - 2)	14.0	9.1	11.9	4.8
12 (Teacher Praise)	.4	.6	.4	.4
13 (Teacher Criticism)	1.0	1.4	1.3	1.4
14 (Non-Productive Activity)	1.1	1.1	1.0	.9
15 (Seatwork or Other Pupil Activities)	.1	.04	2.0	4.9

Table 6.
Summary of the Per Cent of Occurrence of Each
of the Fifteen Categories Within
the Four Treatment Groups

2. Analysis

The first analysis which was made of these data was to determine relative pattern differences across Treatment Groups within grade levels. This involved a matrix comparison technique for which a special computer program was written. The technique compared balanced matrices by use of a modified chi-square formulation. When this technique was used, differences were found among all groups in each grade, significant at the .05 level. In other words, matrices resulting from use of the activity checklist were significantly different from each other for each Treatment Group at each grade level, based on chi-square values. This result was not totally unexpected, but it did not serve to shed any light on the nature of the differences and, therefore, additional analyses were called for. Results of this particular aspect of the study are not reported in data form since the differences were not interpretable.

A second analysis involved grouping activities into general areas and analyzing them according to the percentage of tallies included in each of these areas for each group. The areas of activity included (1) teacher talk, (2) student talk, (3) productive student activity, and (4) non-productive student activity. In the composite group matrices, categories 1, 2, 3, 6, 12, and 13 represent "teacher talk," categories 4, 5, and 7 represent "student talk," categories 8, 9, 10, and 11 represent "productive student activity," and category 14 represents "non-productive student activity." In the first analysis, each Treatment Group was treated as a composite across grade level. These results are summarized in Tables 6 and 7.

	Treatment Group			
	I	II	III	IV
Non-Verbal Productive Student Activity	38.2	33.2	31.0	15.8
Student Talk	18.9	21.7	19.5	28.8
Teacher Talk	41.7	43.9	46.5	49.7

Table 7.
Summary of Calculations Made Upon Composite Matrices

The composite matrix for Treatment Group I indicates that teacher talk occurred 41.7 per cent of the time, student talk occupied 18.9 per cent, non-verbal productive student activity was 38.2 per cent, and non-productive student activity accounted for 1.1 per cent of the total tallies.

The percentage distribution of the total matrix for Group II indicates that teacher talk comprised 43.9 per cent, student talk 21.7 per cent, non-verbal productive student activity 33.1 per cent, and non-productive student activities was 1.1 per cent.

For Treatment Group III, teacher talk comprised 46.5 per cent, student talk made up 19.5 per cent of the total interaction, non-verbal productive student activity was 31.0 per cent, and non-productive student activities accounted for 1.0 per cent of the total interaction.

In Treatment Group IV, teacher talk comprised 49.7 per cent, student talk 28.8 per cent of the total interaction, non-verbal productive student activities 15.8 per cent, and non-productive student activities comprised 0.9 per cent of the total interaction in the classes.

In a second analysis, categories representing "teacher talk," "student talk," and "non-verbal productive student activity" were treated separately by grade level and Treatment Groups.

a. Percentage of Teacher Talk Compared by Treatment Groups at Each Grade Level

The total percentage of teacher talk at each grade level was determined by adding columns 1, 2, 3, 6, 12, and 13 in the composite matrices shown in Tables 8, 9, and 10. These calculations are summarized in Table 11.

In Treatment Group I at the first grade level, teacher talk amounted to 40.8 per cent. In Treatment Group II, teacher talk increased to 46 per cent; in Treatment Group III, teacher talk decreased to 45 per cent; and in Treatment Group IV, teacher talk totaled 50.3 per cent.

At the second grade level in Treatment Group I, the total percentage of teacher talk was 41.7; in Treatment Group II the percentage was 43.5; in Treatment Group III, 45.1; and in the control group, the per cent of teacher talk was 48.3.

The total percentage of teacher talk at the third grade level was 42 per cent in Treatment Group 1; in Treatment Group II, 43.2 percent; Treatment Group III, 49.2 per cent; and in Treatment Group IV, 50.6 per cent.

With two exceptions, the data indicate that the amount of teacher talk increases between grade levels within a Treatment Group and, with one exception, the trend toward more verbal interaction on the part of the teacher is also apparent from Treatment I to Treatment IV.

Category	Treatment Group I	II	III	IV
1	11.3	8.8	15.8	8.5
2	10.0	11.4	8.2	13.1
3	16.1	21.1	13.4	23.9
4	17.0	19.2	18.2	25.6
5	.6	.5	.3	.7
6	2.0	2.7	3.5	2.4
7	.8	1.6	2.0	3.3
8	2.7	10.4	.0	.8
9	17.6	11.2	14.0	4.4
10	2.5	2.5	6.0	6.2
11	16.3	8.3	12.6	4.4
12	.3	.9	.6	.6
13	1.1	1.1	3.5	1.8
14	1.9	.5	2.0	.8
15	.0	.0	.0	3.4

Table 8.
The Per Cent of Occurrence of Each Category of
Interaction Compared by Treatment Groups at Grade One

	Treatment Group			
Category	I	II	III	IV
1	11.6	12.6	12.7	6.7
2	6.8	8.6	7.8	16.4
3	18.4	16.1	21.5	19.5
4	17.1	18.5	14.1	25.0
5	.3	.7	.1	.5
6	3.8	3.4	2.5	3.9
7	2.0	1.9	1.4	2.4
8	11.1	3.8	3.9	.6
9	14.6	18.5	17.0	7.5
10	.0	3.1	.5	2.2
11	13.3	7.9	10.9	5.2
12	.4	.7	.1	.5
13	.7	2.1	.5	1.3
14	.0	1.9	.9	1.2
15	.0	.1	5.8	7.3

Table 9.
The Per Cent of Occurrence of Each Category of
Interaction Compared by Treatment Groups at Grade Two

	Treatment Group			
Category	I	II	III	IV
1	13.1	9.0	11.9	8.6
2	11.4	11.7	14.7	17.8
3	11.8	16.4	17.7	18.3
4	14.5	18.7	18.5	22.7
5	3.3	2.4	1.1	.8
6	4.6	4.7	4.0	4.6
7	1.0	1.6	2.5	5.3
8	1.0	1.8	4.6	2.6
9	19.7	19.2	11.5	7.3
10	2.8	1.4	0	1.5
11	12.0	11.1	12.3	4.8
12	.1	.4	.5	.2
13	1.0	1.0	.4	1.1
14	3.0	.6	.5	.5
15	.1	0	0	4.0

Table 10.
The Per Cent of Occurrence of Each Category of
Interaction Compared by Treatment Groups at Grade Three

Teacher Talk

Treatment Group	Grade 1	2	3
I	40.8	41.7	42.0
II	46.0	43.5	43.2
III	45.0	45.1	49.2
IV	50.3	48.3	50.6

Student Talk

Treatment Group	Grade 1	2	3
I	18.4	19.4	18.8
II	21.3	21.1	22.7
III	20.5	15.6	22.1
IV	29.6	27.9	28.8

Student Activity

Treatment Group	Grade 1	2	3
I	39.1	39.0	35.6
II	32.4	33.4	33.5
III	32.6	38.1	28.4
IV	19.2	22.8	20.2

Table 11.
Comparison of Grouped Behavior Categories
by Grade Level and Treatment

b. Percentage of Student Talk Compared by Treatment Groups at Each Grade Level

The percentage of student verbal interaction was determined by summing the percentages in categories 4, 5, and 7. (See Table 11.)

In Treatment Group I at the first grade level the student talk totaled 18.4 per cent; in Treatment Group II, 21.3 per cent; in Treatment Group III, 20.5 per cent; and in Treatment Group IV the percentage increased to 29.6 per cent.

At the second grade level in Treatment Group I the total percentage of student talk was 19.4; in Treatment Group II this increased to 21.1 per cent; in Treatment Group III, the total dropped to 15.6 per cent; and in the control group the percentage was 27.9.

In grade three, Treatment Group I, the total student tally was 18.8 per cent. The data do not seem to indicate a difference in the amount of student talk between the grade levels within a Treatment Group. The data do indicate, with two exceptions, that at a given grade level the amount of student talk increases from Treatment Group I to Treatment Group IV.

c. Percentage of Non-Verbal Productive Student Activity Compared by Treatment Groups at Each Grade Level

The total percentage of non-verbal productive student activity was obtained by adding the percentages in categories 8, 9, 10, and 11. (See Table 11.)

At the first grade level in Treatment Group I, non-verbal student activities amounted to 39.1 per cent of the total interaction; in Treatment Group II, this decreased to 32.4 per cent; in Treatment Group III the total was 32.6 per cent, and in the control group, Treatment Group IV, the percentage of student activities dropped to 19.2 per cent.

At the second grade level in Treatment Group I non-verbal student activities totaled 39.0 per cent; in Treatment Group II the total decreased to 33.4 per cent; in the Treatment Group III the percentage of student activities increased to 38.1 per cent; and in Treatment Group IV, the percentage total decreased to 22.8 per cent.

At the third grade level the general trend apparent at the first and second grade levels continued. In Treatment Group I, the percentage of non-verbal student activities totaled 35.6 per cent; in Treatment Group II, the total decreased to 33.5 per cent; in Treatment Group III the total decreased to 20.2 per cent.

With the possible exception of the third grade in Treatment Group III, the students taught by teachers in Treatment Groups I, II, and III were engaged more often in productive non-verbal student activities than they were in the control group.

d. Direct and Indirect Teacher Statements

An I/(I + D) ratio was used in this study to provide a measure of the directness or indirectness of teacher statements. A direct statement is interpreted as one which tends to inhibit or hamper student responses. Categories 1, 2, and 13 are considered direct statements in this study. Indirect statements are those statements which tend to encourage student responses and participation. Categories 3, 6, and 12 are considered to be indirect statements in this study.

The I/(I + D) ratio was obtained by dividing the total of the percentages obtained by summing columns 3 + 6 + 12 by the total of columns 1 + 2 + 3 + 6 + 12 + 13. The ratio obtained gives an indication of the ratio of indirect behavior to total behavior. The smaller the resulting number, the more direct is the teacher behavior. The I/(I + D) ratios of the four Treatment Groups indicate that the teachers in the experimental groups were more indirect in their teaching behaviors than the teachers of the control group.

In Treatment Group I, the composite I/(I + D) ratio was 0.468. In Treatment Group II, the ratio was 0.496. The ratio in the third group was 0.463, and the ratio in the control group was 0.349. (See Table 12.)

	Treatment Group			
	I	II	III	IV
I/(I + D) Ratio	0.468	0.496	0.463	0.349
Time Use Ratio	8.3	3.9	6.4	1.5

Table 12.
Indirectness Ratios and Time Use Ratios
Compared by Treatment Groups

e. Time Use by Students

Time use by students was computed by dividing column 11 of the respective matrix summaries by column 10 in each Treatment Group. The number obtained compares productive behavior with non-productive behavior. A number of 1 or greater indicates behaviors that are more productive than non-productive. The data chart indicates that the experimental groups utilized their time to a greater degree than the control group.

In Treatment Group I, the ratio was 8.3; the ratio for the second group was 3.9; the third group had a ratio of 6.4; and the control group had a ratio of 1.5. (See Table 12.)

C. Teacher Questionnaire Data

1. Collection

All teachers included in the project completed a questionnaire near the end of the academic year 1965-1966. This questionnaire was of the closed-end type so teachers were not given unlimited choices of responses. The investigators were aware that some of the possible responses might not have seemed particularly appropriate to individual teachers since such replies might not give a clear picture of the feelings of the respondent relative to a certain point, but this limitation was dictated by the large number of questionnaires to be processed. Therefore, the covering letter to the teachers solicited any additional comments which a respondent might wish to make with regard to any portion of the questionnaire.

The questionnaire was composed of thirty-eight questions, not all of which were appropriate to the experience of all teachers in the four Treatment Groups. Questions 21 through 38 were related to the type of preparation for teaching the course which teachers had experienced, so these questions were not answered by teachers of the control group. Questions 30-38 specifically referred to Science Education 509, the Florida State University number for the course which was offered to teachers participating in the summer Workshop and in-service course programs. Teachers from Treatment Group III who had been given materials but no formal instruction in the "Process Approach" did not answer these questions. A summary of the questions answered by teachers in each of the Treatment Groups is given in Table 13.

Treatment Group	Questions Answered
I	1-38
II	1-38
III	1-29
IV	1-20

Table 13.
Items Answered on Teacher Questionnaire
by Teachers in Each Treatment Group

The questionnaires were sent to contact persons in each school district with letters of instruction for the teachers who were to respond. In many cases the teachers from Treatment Group II received and completed the questionnaires during a meeting of the in-service course. All teachers enrolled in in-service courses completed the questionnaire to provide feedback concerning teacher response to Science Education 509. However, the information presented and analyzed below comes only from the questionnaires of those teachers who were randomly selected to form Treatment Group II as well as from the teachers in the other Treatment Groups.

2. Analysis

a. Questionnaire Item Responses

Responses to items in the questionnaire were tabulated by Treatment Group. These results are reported in Table 14 in terms of both the number and the per cent of teachers responding with each choice.

b. Comments Included with the Teacher Questionnaires by Treatment Groups

(1) Treatment Group I (1965 Summer Institute Participants)

The number of comments returned with the questionnaires of this group, as well as with those of the other three groups, was very limited in number, making any generalized statements about the comments difficult. One teacher did mention that she was pleased with the way math and science seemed to correlate in her classroom. A comment of another teacher was:

"The effect Process Approach has had on students apart from the science portion of their curriculum has been quite helpful. In the teaching of Classification one of my pupils suggested, 'Let's use Classification in this Reading Lesson.' I said, 'All right, John.' I really wanted to find out if he really knew what to do. He showed the class just how he thought it should be done. I think he did quite well. This encouraged other pupils to observe for other processes to be used in the teaching of other areas of the curriculum."

(2) Treatment Group II (1965-66 In-Service Course Participants)

The comments of the teachers in Treatment Group II were related to the length of time of the institute and the cost of getting additional equipment for classroom use.

One teacher stated that:

"It will be almost an impossible task to teach this program right and still allot the required time and emphasis to the other basic subjects, particularly at the first level where we do not have a kindergarten program and there are so many skills to teach. I really believe that under present academic and physical conditions the only way this could be properly taught would be with a special science person."

(3) Treatment Group III (Using Materials Only)

Again with this group it is hard to generalize on the comments since there were so few. One teacher did make the following statement:

"Perhaps I didn't present the lessons as they were 'supposed' to be taught, but I felt this procedure was necessary in my case."

She then went on to explain the general procedure used in presenting lessons. In this instance the procedure seemed quite good, in the sense that it was consistent with the philosophy of the "Process Approach." She also suggested the need for the student to have some type of book in which he can record his observations and results.

Another teacher made the following comment:

"I am concerned about the type of exercises and materials. It has been my observation that the materials were very exciting to children at first and they enjoyed playing with them. However, even after much directed experimentation and discussion, the children when working independently did not use materials in a discovery or scientific manner but in a game or play situation. Also they lost interest in most of the activities after a short time. I guess my question is whether these materials are geared to this age level."

The length of time necessary to gather and prepare the materials was again mentioned as being too long.

(4) Treatment Group IV (Control Group)

There was only one comment available from a teacher in this group.

c. Summary of Comments Included with the Teacher Questionnaires

In general, comments about the in-service course were favorable. Most instructors were highly praised, and many teachers said that this was the most valuable science methods course they had ever had. The biggest complaint was in reference to the length of time required for the course. Most teachers felt that all the material could have been covered in half the time allotted, making a three hour course much more practical than the six hour one. The other major complaint was that the tuition was much too expensive for the individual teacher. Many suggested that perhaps the course could be funded with federal money.

Teachers and children had favorable reactions to the program. A typical comment from one teacher:

"My classroom children have shown a higher interest in science than I have ever seen before. It was a pleasure to teach the AAAS Process Approach. Usually I shied away from science. This year I actually looked forward to it, and would now hate to teach science any other way."

Most teachers felt that the "Process Approach" is appropriate for all children. Many said that it gives the slower children a definite opportunity to succeed which they cannot get in other basic subject areas. The fact that all students can participate was well-liked.

In instances where the "Process Approach" was being used in the third grade, for example, and where the students had not had the "Process Approach" in the first and second grades, certain problems arose. The teachers felt that it would be beneficial for them to be able to observe the processes which come before and after the processes emphasized in the grade level which they were teaching. There were a few complaints that the material was one grade level ahead of the students, while others said that this was the first time that the science material they were using was really appropriate to the grade level.

The biggest complaint concerned the equipment kits. The kits did not contain enough materials and too much time and money had to be spent in getting the additional equipment. Some of the materials that had been included could possibly have been deleted. It was suggested that it would be helpful if a kit of expendable materials could be made available for re-order each year. The kits did not contain enough equipment for large classes. Teachers thought it would be helpful if a list was available designating the materials needed for 30 pupils for each lesson. The kits needed more updating to match the books.

Certain experiments were cited as too lengthy and time consuming. Suggestions were made that certain of these should be dropped.

Treatment Group	NUMERICAL RESPONSE						PERCENTAGE RESPONSE					
	Omits	1	2	3	4	5	Omits	1	2	3	4	5
1. Sex: (1) Female (2) Male												
I	0	26	2	0	0	0	0	92.9	7.1	0	0	0
II	0	30	0	0	0	0	0	100	0	0	0	0
III	0	29	0	0	0	0	0	100	0	0	0	0
IV	0	31	0	0	0	0	0	100	0	0	0	0
2. Age: (1) 20-20 (2) 25-30 (3) 31-35 (4) 36-40 (5) over 40												
I	0	5	6	2	3	12	0	17.9	21.4	7.1	10.7	42.9
II	0	3	8	2	3	14	0	10.0	26.7	6.7	10.0	46.6
III	0	7	3	5	4	11	0	20.7	10.3	17.3	13.8	37.9
IV	0	2	5	2	6	16	0	6.5	16.1	6.5	19.4	51.5
3. Years of teaching experience: (1) 1-3 (2) 4-6 (3) 7-9 (4) 10-12 (5) 13 or more												
I	0	8	7	3	3	7	0	28.6	25.0	10.7	10.7	25.0
II	0	8	8	3	3	8	0	26.7	26.7	10.0	10.0	26.7
III	0	10	3	2	2	12	0	34.5	10.3	6.9	6.9	41.4
IV	0	3	5	3	1	19	0	9.7	16.1	9.7	3.2	61.3
4. Have you ever taught at a level other than primary? (1) Yes (2) No												
I	0	11	17	0	0	0	0	39.3	60.7	0	0	0
II	0	12	18	0	0	0	0	40.0	60.0	0	0	0
III	0	14	15	0	0	0	0	48.3	51.7	0	0	0
IV	0	13	18	0	0	0	0	41.9	58.1	0	0	0

Table 14.
Teacher Questionnaire Responses

Treatment Group	NUMERICAL RESPONSE Omits	1	2	3	4	5	PERCENTAGE RESPONSE Omits	1	2	3	4	5
5. At what level have you had most of your teaching experience? (1) Grades K-3 (2) Grades 4-6 (3) Grades 7-9 (4) Grades 10-12 (5) Other												
I	0	25	1	1	1	0	0	89.2	3.6	3.6	3.6	0
II	0	30	0	0	0	0	0	100	0	0	0	0
III	0	25	4	0	0	0	0	86.2	13.8	0	0	0
IV	0	29	0	1	0	1	0	93.6	3.2	0	0	3.2
6. How many biology courses have you taken since your secondary school training? (1) 0 (2) 1 (3) 2 (4) 3 (5) 4 or more												
I	0	7	8	7	3	3	0	25.0	28.6	25.0	10.7	10.7
II	0	4	11	10	4	1	0	13.3	36.8	33.3	13.3	3.3
III	2	2	10	13	2	0	6.9	6.9	34.5	44.8	6.9	0
IV	1	10	7	5	4	4	3.2	32.3	22.6	16.1	12.9	12.9
7. How many earth science courses (geology, meteorology, astronomy, etc.) have you taken since your secondary school training? (1) 0 (2) 1 (3) 2 (4) 3 (5) 4 or more												
I	0	19	6	3	0	0	0	67.9	21.4	10.7	0	0
II	0	14	9	5	2	0	0	46.7	30.0	16.7	6.6	0
III	2	15	6	6	0	0	6.9	51.7	20.7	20.7	0	0
IV	1	21	7	2	0	0	3.2	67.7	22.6	6.5	0	0

Table 14. (continued)

Treatment Group	NUMERICAL RESPONSE						PERCENTAGE RESPONSE					
	Omits	1	2	3	4	5	Omits	1	2	3	4	5
8. How many physical science courses (chemistry, physics, etc.) have you taken since your secondary school training? (1) 0 (2) 1 (3) 2 (4) 3 (5) 4 or more												
I	0	9	10	4	4	1	0	32.1	35.7	14.3	14.3	3.6
II	0	14	12	4	0	0	0	46.7	40.0	13.3	0	0
III	2	12	9	4	1	1	6.9	41.5	31.0	13.8	3.4	3.4
IV	1	18	9	2	1	0	3.2	58.1	29.0	6.5	3.2	0
9. How many mathematics courses have you had since your secondary school training? (1) 0 (2) 1 (3) 2 (4) 3 (5) 4 or more												
I	0	3	10	10	1	4	0	10.7	35.7	35.7	3.6	14.3
II	0	0	14	8	4	4	0	0	46.7	26.7	13.3	13.3
III	2	3	9	6	5	4	6.9	10.3	31.0	20.7	17.2	13.9
IV	1	4	11	8	4	3	3.2	12.9	35.5	25.8	12.9	9.7
*10. How many total semester hours of science have you had in preparation for teaching? (1) 0-5 (2) 6-10 (3) 11-15 (4) 16-20 (5) 21 or above												
I	1	5	7	6	3	6	3.6	17.9	25.0	21.4	10.7	21.4
II	0	11	6	6	4	3	0	36.7	20.0	20.0	13.3	10.0
III	0	10	4	8	6	1	0	34.7	13.2	27.7	20.9	3.5
IV	2	6	8	10	5	0	6.5	19.4	25.7	32.3	16.1	0

Table 14. (continued)

	NUMERICAL RESPONSE						PERCENTAGE RESPONSE					
Treatment Group	Omits	1	2	3	4	5	Omits	1	2	3	4	5
11. How long has it been since you last had formal academic work in science? (Do not consider the Science Education 509 course when you answer this question.) (1) 1-3 years (2) 4-6 years (3) 7-9 years (4) 10-12 years (5) more than 12 years												
I	0	6	7	4	3	8	0	21.4	25.0	14.3	10.7	28.6
II	0	7	11	2	1	9	0	23.3	36.7	6.7	3.3	30.0
III	0	12	4	2	4	7	0	41.4	13.8	6.9	13.8	24.1
IV	0	2	5	7	1	16	0	6.5	16.1	22.6	3.2	51.6
*12. How many periods per week, on the average, do you allot to science instruction? (1) 0 (2) 1 (3) 2 (4) 3 (5) 4 or more												
I	0	0	1	3	7	17	0	0	3.6	10.7	25.0	60.7
II	0	1	1	3	11	14	0	3.3	3.3	10.0	26.7	36.7
III	0	0	4	5	12	8	0	0	13.8	17.2	41.4	27.6
IV	1	0	2	11	10	7	3.2	0	6.5	35.5	32.3	22.5
*13. What length of time, on the average, do you normally allot to a science period? (1) less than 10 minutes (2) 11-20 minutes (3) 21-30 minutes (4) 31-40 minutes (5) more than 40 minutes												
I	0	0	6	13	7	2	0	0	21.4	46.6	25.0	7.0
II	0	0	3	12	13	2	0	0	10.0	40.0	43.3	6.7
III	0	0	8	10	7	4	0	0	27.6	34.5	24.1	13.8
IV	0	0	4	18	8	1	0	0	12.9	58.1	25.8	3.2

Table 14. (continued)

Treatment Group	NUMERICAL RESPONSE Omits	1	2	3	4	5	PERCENTAGE RESPONSE Omits	1	2	3	4	5
14. Does the classroom in which you teach the science portion of your curriculum have easy access to water (sink, wash basin, etc.)? (1) yes (2) no												
I	0	20	8	0	0	0	0	71.4	28.6	0	0	0
II	0	24	6	0	0	0	0	80.0	20.0	0	0	0
III	0	24	5	0	0	0	0	82.8	17.2	0	0	0
IV	0	26	5	0	0	0	0	83.9	16.1	0	0	0
15. Does the classroom in which you teach have facilities for heat experiments (bunsen burner, portable burner, hot plate, etc.)? (1) yes (2) no												
I	0	12	16	0	0	0	0	42.9	57.1	0	0	0
II	0	17	13	0	0	0	0	56.7	43.3	0	0	0
III	1	12	16	0	0	0	3.4	41.4	55.2	0	0	0
IV	0	12	19	0	0	0	0	38.7	61.3	0	0	0
*16. How would you describe the work space for children in the classroom in which you teach science (tables rather than desks, space to store materials, space to set up long term projects, etc.)? (1) Very good (2) Fair (3) Poor or unsatisfactory												
I	0	3	17	8	0	0	0	10.7	60.7	28.6	0	0
II	0	3	12	15	0	0	0	10.0	40.0	50.0	0	0
III	0	8	14	7	0	0	0	27.6	48.3	24.1	0	0
IV	0	2	18	11	0	0	0	6.5	58.1	35.4	0	0

Table 14. (continued)

Treatment Group	NUMERICAL RESPONSE						PERCENTAGE RESPONSE					
	Omits	1	2	3	4	5	Omits	1	2	3	4	5
*17. How would you describe the basic and supplemental textual materials you have available in your science program? (1) Completely satisfactory (2) Fair (3) Poor												
I	1	6	19	2	0	0	3.6	21.4	67.9	7.1	0	0
II	0	6	21	3	0	0	0	20.0	70.0	10.0	0	0
III	0	9	17	2	0	0	0	32.1	60.7	7.2	0	0
IV	0	9	16	6	0	0	0	29.0	51.6	19.4	0	0
*18. In which portion of the curriculum do you feel science should be included? (1) It should be considered one of the basic subjects. (2) It should be placed in a category with music, art, and physical education as an important supplemental area. (3) It is not appropriate for primary grades.												
I	1	25	2	0	0	0	3.6	89.3	7.1	0	0	0
II	0	24	6	0	0	0	0	80.0	20.0	0	0	0
III	2	19	8	0	0	0	6.9	65.5	27.6	0	0	0
IV	0	25	6	0	0	0	0	80.6	19.4	0	0	0
*19. Evaluate your academic training to date to prepare you to teach the science portion of your curriculum: (1) I feel my training is completely adequate. (2) I feel I have some background but would like additional work. (3) I feel I am poorly prepared.												
I	0	2	23	3	0	0	0	7.1	82.2	10.7	0	0
II	0	6	19	5	0	0	0	20.0	63.3	16.7	0	0
III	0	2	22	5	0	0	0	6.9	75.9	17.2	0	0
IV	0	3	24	4	0	0	0	9.7	77.4	12.9	0	0

Table 14. (continued)

Treatment Group	NUMERICAL RESPONSE Omits	1	2	3	4	5	PERCENTAGE RESPONSE Omits	1	2	3	4	5
*20. Evaluate the science curriculum you are employing during the present school year: (1) It is completely adequate. (2) It is good but needs to be changed, supplemented, or updated. (3) It is inadequate.												
I	1	14	13	0	0	0	3.6	50.0	46.4	0	0	0
II	0	9	21	0	0	0	0	30.0	70.0	0	0	0
III	1	6	19	3	0	0	3.4	20.7	65.6	10.3	0	0
IV	0	6	24	1	0	0	0	19.4	77.4	3.2	0	0
*21. What is your opinion of the kit of materials which is supplied for use with the AAAS "Process Approach" as basic equipment for teaching the course? (1) It is completely adequate. (2) It needs some supplementation. (3) It needs considerable supplemental material (4) It is unsatisfactory												
I	0	2	22	4	0	0	0	7.1	78.6	14.3	0	0
II	0	2	15	11	1	0	0	6.9	51.7	37.9	3.5	0
III	0	2	14	11	0	0	0	13.8	48.3	37.9	0	0

Table 14. (continued)

*22. In your opinion, is the amount of preparation necessary for teaching the "Process Approach," including provision for supplementing the equipment kit, reasonable for what might be expected to implement a curriculum innovation?

(1) Yes, it is reasonable considering the fact that much of the preparation will not have to be replicated.
(2) Yes, it is reasonable, but difficult to the point of possibly adversely affecting my normal teaching situation.
(3) No, it is completely unreasonable.

Treatment	NUMERICAL RESPONSE						PERCENTAGE RESPONSE					
Group	Omits	1	2	3	4	5	Omits	1	2	3	4	5
I	1	18	9	0	0	0	3.6	64.3	32.1	0	0	0
II	1	21	8	0	0	0	3.3	70.0	26.7	0	0	0
III	2	14	11	2	0	0	6.9	48.3	37.9	6.9	0	0

*23. What is your opinion of the textual materials supplied for the "Process Approach?"

(1) They are completely adequate.
(2) They need some supplementation.
(3) They need considerable supplemental material.
(4) They are unsatisfactory.

Treatment	NUMERICAL RESPONSE						PERCENTAGE RESPONSE					
Group	Omits	1	2	3	4	5	Omits	1	2	3	4	5
I	0	7	19	2	0	0	0	25.0	67.9	7.1	0	0
II	0	8	21	1	0	0	0	26.7	70.0	3.3	0	0
III	0	7	15	7	0	0	0	24.1	51.8	24.1	0	0

Table 14. (continued)

Treatment Group	NUMERICAL RESPONSE Omits	1	2	3	4	5	PERCENTAGE RESPONSE Omits	1	2	3	4	5
24. What is your opinion of the amount of science instruction time you have available for teaching the "Process Approach?" (1) Available time is no problem. (2) There is usually enough time except for particularly long exercises. (3) Time is generally inadquate.												
I	1	6	17	3	0	0	3.7	22.3	62.9	11.1	0	0
II	0	5	14	11	0	0	0	16.7	46.7	36.6	0	0
III	0	6	12	11	0	0	0	20.7	41.4	37.9	0	0
*25. How much time do you allow each week to implement the "Process Approach" materials? (1) 1 hour or less (2) 1-2 hours (3) 2-3 hours (4) 3-4 hours (5) 4 hours or more												
I	0	5	11	8	4	0	0	17.8	39.3	28.6	14.3	0
II	0	2	8	10	7	3	0	6.7	26.7	33.3	23.3	10.0
III	0	4	18	5	2	0	0	13.8	62.1	17.2	6.9	0
*26. In your opinion, has the time and effort which you have expended to incorporate the "Process Approach" materials into your curriculum been worthwhile? (1) Yes (2) No												
I	0	28	0	0	0	0	0	100	0	0	0	0
II	0	29	1	0	0	0	0	96.7	3.3	0	0	0
III	2	22	5	0	0	0	6.9	75.9	17.2	0	0	0

Table 14. (continued)

*27. Describe how you plan to utilize the "Process Approach" in your future teaching:
(1) I plan to follow the program exactly as outlined in the manual.
(2) I plan to use the program, departing in several areas I feel are appropriate.
(3) I am undecided.
(4) I will not use the program but will possibly borrow certain activities.
(5) I do not intend to utilize the course at all.

Treatment Group	NUMERICAL RESPONSE Omits	1	2	3	4	5	PERCENTAGE RESPONSE Omits	1	2	3	4	5
I	0	10	16	2	0	0	0	35.7	57.1	7.2	0	0
II	0	3	24	1	2	0	0	10.0	80.0	3.3	6.7	0
III	0	4	14	7	4	0	0	13.8	48.3	24.1	13.8	0

28. What is your opinion of the use of the "Process Approach" with particular types of children from the standpoint of intellectual ability?
(1) The course is appropriate for almost all children.
(2) The course is geared toward the high ability child.
(3) The course is geared toward "average" children but does not provide well for the low or high ability children.
(4) The course is geared toward the low ability child.
(5) The course is not appropriate for primary grade children.

Treatment Group	NUMERICAL RESPONSE Omits	1	2	3	4	5	PERCENTAGE RESPONSE Omits	1	2	3	4	5
I	0	24	3	1	0	0	0	85.7	10.7	3.6	0	0
II	0	23	6	1	0	0	0	76.7	20.0	3.3	0	0
III	0	20	8	1	0	0	0	69.0	27.6	3.4	0	0

Table 14. (continued)

Treatment Group	NUMERICAL RESPONSE Omits	1	2	3	4	5	PERCENTAGE RESPONSE Omits	1	2	3	4	5
29. What is your opinion of the effect the "Process Approach" has on students apart from the science portion of their curriculum? For example, has the work appeared to affect their work in reading, social studies, mathematics, etc.? (1) There seems to be considerable positive effect (transfer) on other areas of the curriculum. (2) There is no noticeable effect (transfer) on other areas of the curriculum. (3) There seems to be considerable negative effect (transfer) on other areas of the curriculum.												
I	0	21	7	0	0	0	0	75.0	25.0	0	0	0
II	3	18	9	0	0	0	10.0	60.0	30.0	0	0	0
III	1	15	13	0	0	0	3.5	51.7	44.8	0	0	0
30. What is your opinion regarding the instruction provided through Science Education 509 to introduce you to the AAAS "Process Approach?" (1) It is completely adequate. (2) It is good but leaves certain gaps. (3) It is generally inadequate. (4) It is unsatisfactory.												
I	2	6	20	0	0	0	7.1	21.4	71.5	0	0	0
II	0	14	16	0	0	0	0	46.7	53.3	0	0	0
31. How would you rate the Science Education 509 course from the standpoint of its effect on your preparation for teaching? (1) It is better than the average of education courses I have taken. (2) It is about average for an education course. (3) It is below average for an education course.												
I	2	24	2	0	0	0	7.1	85.8	7.1	0	0	0
II	0	21	9	0	0	0	0	70.0	30.0	0	0	0

Table 14. (continued)

Treatment Group	NUMERICAL RESPONSE Omits	1	2	3	4	5	PERCENTAGE RESPONSE Omits	1	2	3	4	5
32. How would you rate your instructor from the standpoint of his effectiveness in interpreting the AAAS "Process Approach" materials to you? (1) He is above average as an instructor for such a course. (2) He is about average. (3) He is below average.												
I	4	21	3	0	0	0	14.3	75.0	10.7	0	0	0
II	0	16	14	0	0	0	0	53.3	46.7	0	0	0
33. What is your opinion of the time and effort required for successful participation in the Science Education 509 course? (1) It is excessive. (2) It is about what should be expected. (3) The course is too easy.												
I	4	2	21	1	0	0	14.3	7.1	75.0	3.6	0	0
II	0	9	21	0	0	0	0	30.0	70.0	0	0	0
34. How would you grade the effectiveness of the science content of the Science Education 509 course? (1) It is very useful to me in my teaching. (2) It is moderately useful to me in my teaching. (3) It is practically useless to me in my teaching. (4) No specific science content was incorporated in the course.												
I	2	17	8	0	0	0	7.4	63.0	29.6	0	0	0
II	0	17	11	2	0	0	0	56.7	36.7	6.6	0	0

Table 14. (continued)

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Treatment Group	NUMERICAL RESPONSE Omits	1	2	3	4	5	PERCENTAGE RESPONSE Omits	1	2	3	4	5
35. How would you rate the effectiveness of the "role playing" portion of the Science Education 509 course? (1) It is very useful in terms of my teaching situation. (2) It is moderately useful in terms of my teaching situation. (3) It is not useful in terms of my teaching situation. (4) There has been no "role playing" or teaching practice activity as part of the course.												
I	2	19	7	0	0	0	7.1	67.9	25.0	0	0	0
II	1	16	10	3	0	0	3.3	53.4	33.3	10.0	0	0
36. How would you rate the value of trying out the exercises prior to their implementation in the classroom? (1) This is a very valuable activity. (2) This is a moderately valuable activity. (3) This is not a worthwhile activity. (4) We did not try out the exercises before they were actually used in my classroom.												
I	2	25	1	0	0	0	7.1	89.3	3.6	0	0	0
II	0	24	6	0	0	0	0	80.0	20.0	0	0	0
37. Would you recommend participation in such an in-service course to other teachers who might want to implement "Science - A Process Approach" or another curriculum innovation? (1) Yes (2) Yes, with reservations (different instructor, different location, different format) (3) No												
I	3	25	0	0	0	0	10.7	89.3	0	0	0	0
II	0	21	9	0	0	0	0	70.0	30.0	0	0	0

Table 14. (continued)

Treatment Group	NUMERICAL RESPONSE						PERCENTAGE RESPONSE					
	Omits	1	2	3	4	5	Omits	1	2	3	4	5
38. Do you feel that Science Education 509 has been worthwhile for your purposes? (1) Yes (2) No												
I	2	26	0	0	0	0	7.1	92.9	0	0	0	0
II	1	27	2	0	0	0	3.3	90.0	6.7	0	0	0

Table 14. (continued)

IV. DISCUSSION

The three kinds of data collected in this study were analyzed in different ways, the student test data by statistical treatment, the classroom observation data by grouping and arithmetical procedures, and the questionnaires by simple percentage calculations and summarizing of comments. However, since all the data was to be used in answering the questions posed at the beginning of this report, some further discussion seems necessary.

A. Student Test Data

The Treatment Groups within each grade level were found to be homogeneous with respect to a general ability measure as shown by analysis of variance on ability measure scores. This made it reasonable to do an analysis of variance for comparison of levels and Treatments on the test scores (the "Process Instrument").

As was shown in Table 5, the differences among Treatments were not significant in many instances. Of 144 paired comparisons 18 were found to be significant at the .01 or .05 level. Six of these comparisons favored the in-service group, four the Summer Institute, four the materials-only, and four the control group.

Only one significant F value was detected among the four Treatment Groups at the first grade level. This was in the space/time process and it was significant at the .01 level. Successive tests using various combinations of the four Treatment Groups revealed that only the control group contributed to this variance. Therefore, the control group children could be considered as achieving significantly lower than students in the other three Treatment Groups in this particular process.

At the second grade level there were significant differences between groups for three processes: classifying, communicating, and predicting. Treatments I and III resulted in significantly greater student achievement on the classifying measure than did Treatments II and IV.

For the communication and prediction processes, however, results were reversed. Treatment Groups II and IV scored significantly higher than Groups I and III.

The same kind of generalization suggested for other grades can be applied for third grade students after examination of test scores. Only for the space/time process was there any difference between groups. For that single measure, the control group scored significantly lower than any of the other Treatment Groups.

When scores on all processes in each Treatment Group at each grade level are added together to give total scores, results are more along the lines which might have been predicted. In the first grade the control students did score lower than other groups. The other three Treatment Groups were relatively close together although it is somewhat surprising that Group III was higher than Group I. This same order of scores resulted for the third grade where both Group IV and Group I students were lower in total score. Only in the second grade did Group I students perform better than Groups III and IV, a result that had been anticipated by the experimenters.

B. Classroom Interaction Data

The goals of the "Process Approach," particularly student participation in activities and student acquisition of skills in the identified processes, suggest that teaching methods which maximize student activity and minimize teacher authoritarianism would be desirable. To the extent that this is so, the analysis of classroom interaction data suggests that, in general, any method of teacher instruction (of the three used in this study) is superior to no instruction, coupled with no use of "Process Approach" materials.

It may also be seen in Table 11 that Treatments I and II are somewhat superior to Treatment III, but it is hard to distinguish between the in-service and Summer Institute courses in their effectiveness in achieving the stated goals. The I/(I + D) ratio was highest for the in-service group; the Summer Institute group was next, with the materials-only group third.

C. Teacher Questionnaire Data

Certain questions were considered by the investigators to offer information relating to differences or similarities in the opinions of teachers from the four Treatment Groups. A notation of the qualitatively observable trends in questionnaire data follows, identified by question number.

Question 10: A larger number of teachers from Treatment Group II had less than 5 semester hours of science in preparation for teaching. Group IV had by far the largest number of teachers with 11 to 15 semester hours of science as preparation. It would certainly seem to make some difference in the over-all results of the project if the teachers from Treatment Group IV had enough science training in preparation for teaching to off-set the advantages which the teachers in Groups I and II had gained from their participation in summer and in-service courses.

The answers to question 12 indicate a regular downward progression in the percentage of teachers from each of the

Treatment Groups who allotted more than four hours per week to the teaching of science. In Treatment Group I sixty per cent of the teachers allotted more than four hours and, reading downward in order, in Treatment Group II it was 47 per cent, Treatment Group III, 28 per cent, and Treatment Group IV, 23 per cent. So the previous experience of the teachers in each of the Treatment Groups as well as their current involvement in new programs apparently had some effect on the total number of hours which they devoted to science instruction during any given teaching week.

Question 13: There are some interesting observations to be gained from an examination of teacher-information regarding the length of time normally allotted to a science instructional period. Apparently most teachers in all of the Treatment Groups used 21 to 30 minutes for a typical science period. However, in Group II (the teachers who had in-service experience) a large number of teachers spent 31 to 40 minutes in a typical science instructional period. It is also interesting to note that quite a large number of teachers from Treatment Group I (21 per cent) allotted only 11 to 20 minutes for a science instructional period. There is, then, some definite difference in the amount of time allotted for science instruction between the teachers who attended the Summer Institute and those who participated in the in-service program. More of the teachers in the in-service program allotted a longer time to science instruction each day.

Question 16 yields interesting information regarding the work space in the classroom which teachers in the different Treatment Groups had available for their children. This question asked them to describe the work space in terms of numbers of tables and amount of storage and project space in their classrooms. Half of the teachers in Treatment Group II had what they described as a poor amount of work space in their classrooms. The majority of teachers in all the other Treatment Groups had work space which they described as fair. By far the largest percentage of teachers who had work space which they described as very good were in Treatment Group III. Only about 10 per cent of the teachers in Group I and in Group II had work space which they described as very good, but 28 per cent of those in Group III had work space which they described in this way. It might perhaps be supposed that in this sense the teachers from Treatment Group III do not form a typical sample since such a large number of them had extremely good facilities for teaching elementary school science. Another interpretation, however, is that teachers involved in the new science course were more critical of their facilities, perhaps because of the new experiences they were having.

The data from question 17 seems to indicate that teacher-opinion regarding the basic and supplemental textual materials which they had available in their science program is fairly consistent throughout the Treatment Groups. Twenty to thirty per cent of the teachers in each of the four Treatment Groups considered their textual materials completely satisfactory, while 60 to 70 per cent of the teachers in each of the four groups considered that these materials were fairly satisfactory. So there are really no noticeable differences in teacher opinion regarding the textual materials available in any of the four Treatment Groups.

Question 18 indicates a teacher opinion which is of some importance in an evaluation of the effectiveness of in-service training in changing the attitudes of science teachers. The question concerns the portion of the curriculum where science should be included. Eighty to ninety per cent of the teachers in Treatment Groups I, II, and IV consider science to be one of the basic subjects, but a rather large percentage (27 per cent) of Group III teachers thought that science was an important supplemental area rather than a basic subject. It might be supposed that this attitude toward the placement of science in the curriculum influenced some other teacher opinions regarding the general effectiveness of the "Process Approach" and the time required to implement this approach.

The answers to question 19 indicate practically no differences among teachers in the four Treatment Groups regarding their opinion of their own preparation for teaching science as a portion of the total curriculum. Seventy to eighty per cent of the teachers in each of the four Treatment Groups felt that they had some background for teaching science but would like additional work in this area. This data seems to be a confirmation of the general similarity of the backgrounds and outlooks of teachers from the four Treatment Groups.

Question 20 points to a definite difference in opinion between the teachers in Treatment Group I and those in Group II on the adequacy of the science curriculum they were currently using. In both cases, the science curriculum was the AAAS "Science - A Process Approach." About fifty per cent of the teachers in Treatment Group I considered this approach to be completely adequate but only about thirty per cent of the teachers in Treatment Group II considered it to be so. This information seems fairly inconsistent with other answers of the same teachers because in many cases these same teachers indicated greater enthusiasm toward use of the AAAS materials and seemed generally better informed about the philosophy of the "Process Approach." The difference between the teachers in Treatment Group I and in Treatment Group II are the same kinds of differences which appear with respect to several later questions. That is, more of the teachers from Treatment Group I seemed to indicate general satisfaction with the AAAS materials and approach then those in Treatment Group II.

From question 21 it is apparent that the teachers who participated in the Summer Institute were more thoroughly convinced of the adequacy of the physical aspects of the AAAS approach and materials. Only fourteen per cent of the teachers in Treatment Group I thought the AAAS kit was inadequate while thirty-seven per cent and thirty-eight per cent of Treatment Groups II and III, respectively, thought the kits were inadequate for teaching purposes.

Question 22 showed that about one-third of the teachers in each of the four groups felt that the amount of time required to implement the "Process Approach" was enough to affect the teaching situation adversely.

A fairly large number of teachers in Group III indicated in their answers to question 23 that the materials which they used needed considerable supplementation. Twenty-four per cent of the teachers in Group III felt that supplementary materials were needed, while only seven per cent and three per cent of teachers in Treatment Groups I and II had the same feeling. This can be explained in part by the fact that teachers in Groups I and II prepared their additional materials as part of the requirement for the course they were taking.

About thirty-seven per cent of the teachers in both Groups II and III felt that the time they had for AAAS instruction was generally inadequate, but only about 10 per cent of the teachers in Treatment Group I felt the same way. Answers to other questions indicate that the teachers from Treatment Group I could have held this opinion because they were more confident using the AAAS materials.

The answers to question 25 indicate that the teachers in Treatment Group II spent more time each week than other groups using the "Process Approach." Interestingly enough, 20 per cent or one-fifth of the teachers in Treatment Group I spent less than one hour per week on AAAS. This is one of the questions that seemed to indicate that even though teachers in Treatment Group II had more specific objections to the adequacy of the materials and the general approach to AAAS, a greater number of them seemed to be spending more time trying to use it with their students than were the teachers in Treatment Group I. Being enrolled in Science Education 509 while teaching the elementary class undoubtedly contributed to this fact.

In the answers to question 26 there is a rather noticeable difference in the percentage of teachers who thought that the time and effort involved in implementing the AAAS approach was worthwhile. One hundred per cent of the teachers in Group I felt that the time spent was worthwhile, 97 per cent of the teachers in Treatment Group II felt this way, and 76 per cent of the teachers in Group III. Apparently, a successful experience with the materials in either the in-service course or the Summer

Institute gave teachers a better foundation for the amount of effort required and a resultant positive attitude toward the course.

One of the most important pieces of information from the teacher questionnaire comes from the answers to question 27. This question asked the teachers to describe how they planned to utilize the "Process Approach" in future teaching. Thirty per cent of the teachers in Treatment Group I planned to follow the program exactly as outlined in the manual but only ten per cent of the teachers in Group II planned to do so and 13 per cent of the teachers in Group III. Apparently something which was done in the in-service courses influenced the result in the second Treatment Group such that a larger percentage of teachers in the group gave the more desirable reply. This desirable result was described by the second answer to the question, "I plan to use the program, departing in several areas I feel are appropriate." Eighty per cent of the teachers in Treatment Group II chose this answer.

Question 28 revealed that more teachers from Treatment Group III thought the course was geared toward the high-ability child. This indicates that at least one important outcome of formal instruction (either an in-service course or Summer Institute) was the development of the realization that such materials could be geared for the average or below average child. Eighty to eighty-five per cent of the teachers in both Treatment Groups I and II held this opinion.

Question 29 seems to indicate that there was not a lot of difference in the opinions of teachers of the various Treatment Groups regarding the effect the "Process Approach" had on the student apart from the science portion of the curriculum. There were slight differences between Treatment Groups I and II and Treatment Group III. Sixty to seventy-five per cent of the teachers in the first two Treatment Groups felt that there was considerable transfer to other areas of the curriculum but only 50 per cent of the teachers in Treatment Group III felt this way.

It should again be noted here that the answers to the remaining questions were given only by teachers in Treatment Groups I and II. These questions specifically concerned the course, Science Education 509, which was offered in the in-service program and the summer Workshop. The answers to these questions, then, are a comparison of the opinions of teachers from the first two Treatment Groups regarding this course.

Question 30 indicates that only about 24 per cent of the teachers in Treatment Group I felt that Science Education 509 was completely adequate. This does seem fairly strange since in answers to other questions the teachers of this Treatment Group were apparently extremely well-informed on the philosophy of AAAS and convinced that the entire program was worthwhile. On the other hand, 47 per cent of the teachers in Treatment Group II felt that the course was completely adequate, although more had expressed some doubts about the approach.

The answers to questions 31 and 32 seem to show that there must have been some difference in the general effectiveness of the instructors in the Summer Institute and those who taught the in-service courses. In the case of teacher rating of Science Education 509, eighty-five per cent of the teachers from Treatment Group I rated the course as better than the average of education courses they had taken while only 70 per cent of teachers from Treatment Group II did so. It would seem that this opinion is directly related to the opinion given in question 32 regarding the effectiveness of the instructor. Seventy-five per cent of the teachers in Treatment Group I considered their instructor for Science Education 509 to be above average as an instructor, but only 53 per cent of the teachers in Treatment Group II had this opinion about the instructor of their in-service course.

Question 33 provides an interesting side-light concerning the amount of time required for successful participation in Science Education 509. Only seven per cent of the teachers who took the course in the summer felt that the time and effort required for successful participation in the course was excessive but 30 per cent of the teachers who took it as an in-service course felt that the time required was excessive. This might be very simply related to the fact that the teachers in the summer were not also teaching their own classes at the same time.

In question 34 about the same number of teachers from both groups, approximately 60 per cent in each case, felt that the science content and the role playing which formed part of the content of Science Education 509 were very useful to them in their teaching. Most of the teachers, regardless of Treatment Group, considered both the science content and the role playing parts of the course generally useful. The same similarity of views was noted in the answers to question 36. About eighty per cent of all teachers felt that trying out the exercises prior to their implementation in the classroom was a very valuable activity.

The answers to question 37 seem to indicate important differences in attitude between teachers from Treatment Groups I and II toward recommending participation in a course such as Science Education 509 to other teachers who might want to implement science curriculum change. About ninety per cent of the teachers in Treatment Group I (who took Science Education 509 as part of a Summer Institute) would unqualifiedly recommend participation in such a course, but only 70 per cent of the teachers in Treatment Group II would do the same. Thirty per cent of the teachers would recommend with reservation such participation. It is quite interesting to note that the first reservation listed in the question was the choice of a different instructor. This seems related to answers given to other questions mentioned above regarding real or apparent differences in the general effectiveness of instructors in the summer and in-service courses.

The answers to question 38 indicate practically no difference between teachers in the two Treatment Groups as to whether or not Science Education 509 had been a worthwhile course for the purposes of the teachers. Ninety to ninety-three per cent of the teachers indicated that they did consider the course worthwhile.

V. CONCLUSIONS

Analysis of student test data did not yield enough information for clear-cut conclusions; however, the indication is that the course, Science Education 509, used both in a Summer Institute and in an in-service program, is effective in preparing teachers to use the AAAS, "Science - A Process Approach" curriculum. In terms of the performance of students on the "Process Instrument" the indication is that classes of teachers in the in-service programs are superior to others but differences are slight.

The fact that the four groups of first grade students tested differed significantly on only one of the six processes indicates that, on the basis of relative achievement of students, none of the techniques utilized for making teachers familiar with "Process Approach" materials was superior. As a matter of fact, it apparently did not matter whether teachers even employed the "Process Approach" or not according to the data.

At the second grade level also the results indicate that, insofar as achievement of second grade students as measured by the Process Measure was concerned, teacher training method did not make any difference nor, in general, did it make any difference whether any treatment was applied.

In grade three Group II students had the most consistently high scores and would have to be judged the superior Treatment Group in terms of total score on the "Process Instrument."

The two null hypotheses stated on page seven of this report could not be rejected according to the statistical data assembled from this experiment. There were no differences among children in the three Treatment Groups insofar as scores on the "Process Instrument" were concerned and the children in the three Treatment Groups did not differ significantly from those in the control group on this measure.

Information from the classroom interaction observations indicates that teachers in Treatment Group II exert less direct influence in their classes than teachers in any other group. In this behavior teachers in Groups I and III were lower than those in Group II, but they were not greatly different from each other. All three experimental groups were greatly superior to the control group.

The data from teacher questionnaires yielded confirmation of some conclusions which might be predicted logically from a study of the project design. These conclusions concerned the desirable outcomes of in-service courses and summer Workshops which orient teachers in the use of new curriculum materials.

The teachers from Treatment Groups I and II were more enthusiastic about the entire "Process Approach" than were the teachers from Groups III and IV. The teachers who had some formal introduction to the AAAS philosophy and materials saw more benefits to students from such an approach, devoted more instructional time to science in the curriculum, planned to continue to use the "Process Approach" in the future, and felt the approach deserved the time and effort required to introduce it into the classroom. Teachers who did not have formal instruction exhibited such behaviors and opinions much less frequently.

The data also revealed important differences in the opinions and behaviors of teachers who experienced the two different kinds of instructional programs. In general, it seems that teachers who participated in the in-service courses received more desirable long term benefits. In some cases these teachers did not exhibit such outward enthusiasm for the program in answers on the questionnaire as did the teachers from Treatment Group I, but the majority of the in-service trained teachers used longer classroom instructional periods than the summer trained teachers, and they also seemed to have a much different attitude toward future teaching of the course. While the teachers from Treatment Group I indicated a basic commitment to the AAAS approach by their reaction to such items as the adequacy of the equipment kit and the textual materials, they did not seem to be as dedicated to the actual classroom implementation of the course as did the teachers from Group II.

VI. POSSIBLE LIMITATIONS OF STUDY

While the investigators have concluded that in-service courses offer the best instruction for teachers who wish to introduce the AAAS, "Science - A Process Approach," curriculum (among the types of instruction used in this study) the evidence for this conclusion is not strong. The student test data would seem to provide the best evidence for this conclusion but the number of significant differences found in these data was small.

The "Process Instrument," although it was developed specifically as an evaluation tool by the AAAS curriculum designing team, had received very limited previous use and no information was available concerning its validity and reliability. The instrument was not appropriate for use with small children in its original form because of the time required for its administration. The instrument was, therefore, tailored for use in this study by deletion and editing, with experienced users of the instrument serving as a panel to judge which questions might be retained and which deleted. As a result, the test was somewhat altered from its original form. The unexpectedly good showing of the control group on this instrument would tend to cast doubt on its sensitivity toward material specific to the "Process Approach" curriculum.

The classroom interaction observations were made by trained observers and are thus probably good data but no inter-observer reliability was established. The 15 observation categories were tailored to fit the needs of this study and were not validated in any way except opinion sampling. Some of the categories would seem difficult to record, numbers 9, 10, 11, and 14. Since a "subset" is subject to various size interpretations it may have been difficult for observers to distinguish between categories 10 and 11. Categories 10 and 14 are also quite similar.

It is recommended that if the set of 15 categories used in this study is used again two observers make the recordings, one recording the non-verbal student activities and the other recording the student and teacher verbal behaviors.

Some interaction data was lost because of the failure of two observers to complete their assignments.

The teacher questionnaires in this study were subject to the usual ills of questionnaires except that of collection. Returns were excellent but, of course, it is impossible to say how truthfully each item was answered.

VII. SUMMARY

The purpose of this study was to examine three approaches to in-service teacher education in an attempt to determine which was the most effective in preparing teachers to use a new curriculum in science. The level was elementary school; the curriculum was the AAAS, "Science - A Process Approach;" and the three methods of instruction were (1) a Summer Institute, (2) a year-long in-service course, and (3) the provision of a "teachers' guide" and instructional materials. A control group of teachers who did not receive any instruction and who did not teach the "Process Approach" was also used in the study.

The Summer Institute was conducted during a five-week period in the summer of 1965 and the other instructional phases of the project took place during the academic year 1965-66. Teachers were instructed in the in-service courses by a group of "adjunct professors," who were mostly junior college science teachers and who had been specially trained in the AAAS materials in a Workshop held in the summer of 1965. All courses were conducted under the sponsorship of the Department of Science Education at Florida State University. The "teachers' guide" used in one instructional approach was prepared by the AAAS curriculum development team.

Of the approximately 620 teachers who received instruction in this project, 90 were selected as subjects in the study, and 30 additional teachers were selected for the control group. Evaluation was carried out using three techniques: (1) testing of a random sample of students in the classes of participating teachers - four students, two boys and two girls, in each class; (2) observations made on the interactions in classrooms of participating teachers; and (3) use of a questionnaire to assess teacher attitudes and opinions. The instrument used in (1) was the "Process Instrument" which was designed to measure achievement on the processes (taught in the "Process Approach") of measuring, classifying, communicating, predicting, using space/time relations, inferring, using numbers, and observing. This instrument was prepared by the AAAS writers.

The device used in (2) was a modification of the classroom interaction analysis techniques developed by Ned Flanders and others. Observations were made twice for each teacher by a corps of trained recorders and analyzed by a team experienced with this tool. The questionnaire used in (3) was designed by the project staff and administered at the end of the academic year 1965-66. The "Process Instrument" also was used as a post-only test.

Analysis of variance on Metropolitan Reading Readiness Test scores (for first grade students) and on California Test of Mental Maturity I. Q. scores (for second and third grade students) permitted acceptance of the hypothesis that the students at each grade level were from a homogeneous population across Treatment Groups. [Treatment Groups were (1) Summer Institute, (2) in-service year-long course, (3) teachers' guide plus materials, and (4) control.] Analysis of variance, then, on "Process Instrument" scores permitted rejection of the null hypothesis that there was no difference between Treatment Groups in 18 instances at the .01 or .05 level of significance. The processes for which significant differences were found were: using space/time relations (first grade), classifying (second grade), communicating (second and third grades), and predicting (second grade). Six of these differences favored the in-service treatment, four the Summer Institute, four the teachers' guide plus materials, and four the control group.

Matrix analysis of classroom observation data showed clearly that teachers in the in-service group were the least direct in their influence on students. Those in the Summer Institute group were second least direct, the teachers' guide group was third, and the control group teachers were by far the most direct. [The respective I/(I + D) ratios were 0.496, 0.468, 0.463, and 0.349.] Since the goals in the "Process Approach" courses involve greater student involvement and less teacher direction than is the case in older kinds of elementary school science, this result seems to point to the superiority of the in-service year-long course as a teacher education procedure.

Summation and analysis of teacher questionnaire responses, too, indicated that teachers in both the Summer Institute and in-service courses were more enthusiastic about using the "Process Approach" curriculum than teachers in the other two groups. However, the fact that teachers in the in-service course group were generally more willing to expand, modify, and apply the AAAS materials seems to point again to the superiority of this approach in teacher education.

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X. APPENDICES

A. Schedule of Information Conferences

B. Samples of Forms Used to Solicit Interest and Obtain Approval of Local School Officials

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M. NDEA Special Projects Proposal, 1965-66

N. NDEA Project Final Report

O. First Technical Progress Report on USOE Project

P. Second Technical Progress Report on USOE Project

Appendix A

Schedule of Information Conferences

County in Which Conference to Be Held	Place of Meeting	Date
Alachua	County Superintendent's Office	March 11
Bay	Bay County Instructional Staff Office	January 27
Brevard	Spessard Holland Elementary School, Satellite Beach	February 18
Broward	Auditorium, Broward County Instructional Building	February 24
Columbia	Lake City Junior High School (on US 90 west of 41 intersection)	February 2
Dade	Auditorium, Lindsey-Hopkins Hotel, Miami	February 22
Duval	508 Duval County Courthouse	April 4
Escambia	Bellview Junior High School, Pensacola (8 miles west on US 90)	January 26
Hillsborough	Ballroom, University of Tampa	February 17
Lake	Leesburg Civic Center	February 11
Lee	Edison Park Elementary School, Euclid Avenue, Fort Myers (South of town, one block off Route 41)	February 26
Madison	North Florida Junior College	January 28
Manatee	Social Science Building, Manatee Junior College	February 18
Marion	Science Building Auditorium, Central Florida Junior College	February 5
Orange	Rollins College	February 9
Palm Beach	Audio-Visual Room, Administration Building, Palm Beach Junior College	February 25
Polk	Room 137, Science Building, Florida Southern College	February 19
Putnam	St. Johns River Junior College	February 4
St. Lucie	Indian River Junior College	February 19
Volusia	Mainland Senior High School, Daytona Beach	February 8

Samples of Forms Used to Solicit Interest and Get Local Approval

QUESTIONS AND ANSWERS
for the
SCHOOL ADMINISTRATOR

WHAT MUST OUR SCHOOL DO TO TAKE PART IN THE PROGRAM?

1. One or more teachers from your school must be enrolled in an in-service FICUS course designed to introduce the AAAS "Process Approach."

> In order for the teacher to be accepted for the in-service FICUS course, he or she must hold a type III certificate and be willing to pay the tuition costs involved.

2. The school must agree to purchase materials and equipment designed to accompany the Process Approach.

HOW MUCH WILL IT COST THE SCHOOL?

It is anticipated that the cost of necessary materials will be approximately $100 for each participating teachers's classroom. Since the materials are on the NDEA approved list, approximately $50 of local funds per classroom will be required. Since no text materials are required, there will be no additional cost for textbooks. Teacher texts will be the responsibility of the teacher participating in the in-service FICUS course.

WHO IS SPONSORING THE EFFORT TO INTRODUCE THE AAAS PROCESS APPROACH TO THE ELEMENTARY SCHOOLS OF FLORIDA?

The American Association for the Advancement of Science's Commission on Science Education has given permission for these materials to be widely disseminated in the state of Florida. They have agreed to the Science Education Department of the Florida State University taking the administrative responsibility for organizing this effort. In addition, the State Department of Education and the Floirda Institute for Continuing University Studies have lent active support to the program. The USOE has strongly encouraged this project. It is also anticipated that there will be some financial support from them.

HOW WERE THE MATERIALS DEVELOPED?

The AAAS "Process Approach" evolved from a writing conference held at Palo Alto, California, during the summer of 1963. The

Questions and Answers for the School Administrator (continued)

writing team was made up of experts from each of the scientific disciplines and educators with experience ranging from elementary school teaching through training of teachers at the college level. Revision of the material was accomplished with a second writing conference held at Palo Alto during the summer of 1964.

IF ACCEPTED AS A PARTICIPATING SCHOOL, WHAT WILL BE OUR RESPONSIBILITIES?

In order to qualify, a school must agree to purchase materials as described earlier and must insure that the participating teacher attends the in-service institute during 1965-66. Any encouragement or assistance which the school administration can give the participating teacher will be helpful. Participating teachers will be expected to follow the "Process Approach" as closely as possible to give the new curriculum a fair tryout. A minimal amount of testing and evaluation may be necessary to properly judge the materials. Participating schools will be expected to accommodate researchers connected with the program.

IS THIS A NATIONAL PROGRAM?

The American Association for the Advancement of Science represents a nation-wide organization of scientists. The "Process Approach" writing conference was supported by the National Science Foundation. Tryout has gone on in a number of centers across the country. When the total K-6 program is completed, it will be disseminated on a general basis throughout the country. This is by far the largest scale curriculum project ever attempted at the elementary school level.

IS THIS A CONTINUING PROGRAM?

The Process Approach materials will have been developed for grades K-6 by the time this project is initiated. Although the initial program in Florida is only for grades K-3, it is hoped that expansion of the program will be possible after the first year.

WHOM DO I CONTACT IF I HAVE FURTHER QUESTIONS ABOUT THIS PROGRAM?

Phillip R. Fordyce
Associate Head for Special Instructional Programs
Department of Science Education
Florida State University
Tallahassee, Florida

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Appendix B-3

QUESTIONS AND ANSWERS
for the
TEACHER

WHO IS ELIGIBLE TO PARTICIPATE IN THE PROGRAM?

Any first, second, or third grade public school teacher in the state of Florida is eligible provided that he or she holds a type III certificate (or baccalaureate degree from an accredited college or University). An additional criterion is the willingness of the participating teacher to enroll in and take part in a FICUS in-service course designed to introduce the "Process Approach" concurrent with the introduction of the materials into the classroom.

IS THERE ANY COST TO THE CLASSROOM TEACHER?

The only cost to the classroom teacher is tuition and materials for enrollment in a FICUS-sponsored in-service course. Tuition for a six-semester-hour graduate-credit course is $72 for the school year, 1965-66

WHEN AND WERE WILL THE IN-SERVICE COURSE BE HELD?

The in-service course will be held one late afternoon or night a week for thirty weeks during the regular academic year. It is anticipated that most classes will be held at the junior college in the area which is probably centrally located in most population centers. Where this is not the case, efforts will be made to find a location within reasonable commuting distance for all participants.

WHAT KIND OF COURSE CREDIT IS INVOLVED?

Successful completion of the in-service course will result in six semester graduate credits in science education. These credits can be applied to a master's degree program at the Florida State University or at one of the other state universities in Florida.

WHEN WILL THE PROGRAM COMMENCE?

The in-service course will run concurrent with the introduction of the AAAS "Process Approach" in the classroom. The first meeting of the in-service course will probably be held during the week prior to the opening of school in 1965-66 and run throughout the school year.

Questions and Answers for the Teacher (continued)

MUST SPECIAL TEACHING MATERIALS BE COLLECTED?

A kit of teaching aids designed specifically to accompany the "Process Approach" will be purchased by the elementary school for each participating teacher as a requisite to the introduction of the course. These materials will generally suffice to carry out all of the activities suggested in the "Process Approach." Where additional materials are necessary, they will be the common things ordinarily available in any elementary classroom.

ARE SPECIAL SKILLS, SUCH AS READING ABILITY, REQUIRED ON THE PART OF MY STUDENTS?

The AAAS "Process Approach" has been specifically designed to encourage student activity and participation by all. Therefore, it is not dependent on any specific student skills. For example, the accompanying text materials have been written only for the teacher at the first few grade levels. No texts will be placed in the hands of children. Once instructions for a particular activity have been given to the children, they are encouraged to take an active part and proceed with minimal direction. Skills are developed rather than initially required.

HOW HAVE THESE MATERIALS BEEN TESTED?

The Process Approach materials were developed by a writing team of educators and scientists over a three-year period. They have been tried out in some two hundred classrooms across the United States during the past two years. Feedback information has been provided by the trial teachers so that appropriate revisions could be made. The final product of this experimental effort will be employed in the program to be initiated in Florida during 1965-66. Florida will be the first area in the country to attempt the incorporation of the "Process Approach" on a large-scale basis. This dissemination effort is an experiment, in part, to determine the most effective means of implementing new curricula on a large-scale basis. As a participating teacher you will be an early participant in a program which will undoubtedly have a considerable impact on elementary science education throughout the United States.

WHOM DO I CONTACT IF I HAVE FURTHER QUESTIONS REGARDING PARTICIPATION IN THIS PROGRAM?

Phillip R. Fordyce
Associate Head for Special Instructional Programs
Department of Science Education
Florida State University
Tallahassee, Florida

Appendix B-5

FSU-AAAS ELEMENTARY SCIENCE PROJECT
AGREEMENT

As the administrator of ____________________ Elementary School,
(name)
I wish to use the AAAS Elementary Science - Process approach program in our (____first; ____second; ____third) grade classes. (Total number of teachers: ____.) This is done with the understanding that the school system will purchase the necessary instructional materials. (Estimated cost is $50 per classroom. Materials are approved for purchase under NDEA.)

Our school (____would; ____would not) be willing to serve as a control school in the project.

____
(signature of school principal)

I desire to participate in the program to incorporate the AAAS Process Approach for elementary school science in my classroom. I understand that my obligation in doing so will involve enrollment in a six-credit FICUS course during 1965-66 which is to be held at a convenient nearby location. (Tuition cost of $72 for the in-service course is the responsibility of the individual classroom teacher.)

____
(signature of elementary school teacher)

I (____will; ____will not) be available, if selected, to attend a five-week Summer Institute which will be held on the campus of the Florida State University during the period June 21, 1965, to July 23, 1965. (Instruction will be similar to that planned for the in-service FICUS course and will be considered in lieu of such a course for successful participants. Participants will be selected at random from among those indicating their availability and will be paid an appropriate stipend. Tuition and books will also be provided.)

____
(signature of elementary school teacher)

FSU-AAAS Elementary Science Project Agreement (continued)

This agreement form is to be mailed by April 1, 1965, to:

Phillip R. Fordyce
Department of Science Education
Florida State University
Tallahassee, Florida

- -

FSU-AAAS ELEMENTARY SCHIENCE PROJECT
INFORMATION SHEET

1. Teacher's Name: Miss / Mrs. ____________________
2. Degree(s): ______ Institution(s) ____________ Year(s) ______
3. Teacher's Mailing Address: ____________________

   ____
4. Teacher's Summer Mailing Address (if different):

   ____

   ____
5. Name of School: ____________________
6. Address of School: ____________________

   ____
7. Name of Principal: ____________________
8. Name of County Superintendent: ____________________

Appendix C-1

Outline of Workshop Program for
Preparation of Adjunct Professors - Summer, 1965

AAAS Dissemination Workshop Schedule

WEEK I

June 21 Monday

*Session 1 - Education 201

8:00-8:15 Welcome and Introductions (Brakken)

8:15-9:00 AAAS "Process Approach" teaching demonstration (Leedham)

Session 2 - Geology 106

9:30-11:00 Discussion of demonstration and introduction of "Process Approach" (Pierce)

11:00-11:45 Registration

Session 3 - Geology 106

1:30-2:30 Overview of the AAAS Dissemination Project (Brakken)

2:30-3:30 Overview of the Summer Workshop (Leedham) distribution of books and materials

****

June 22 Tuesday

*Session 1 - Education 201

9:00-10:15 New Science Curricula (Marshall)

10:30-12:00 The AAAS "Process Approach" - History and Development (Kurtz)

Session 2 - Geology 106

1:30-3:30 An Orientation to the elementary school (Morrison)

****

* Combined Institute and Workshop groups

June 23 Wednesday

Session 1 - Various elementary schools

8:00-12:00 Visitations to elementary schools and discussion of problems with elementary teachers

*Session 2 - Math-Meteorology 101

1:30-3:30 History and Evolution of the Elementary School Science (Podendorf)

* * *

June 24 Thursday

*Session 1 - Education 201

9:00-10:00 The "Process Approach": Definition and Rationale (Kurtz)

10:15-12:00 A Learning Hierarchy (Gagne)

Session 2 - Geology 106

1:00-2:00 The "Process Approach" As A Biologist Sees It (Kurtz)

*Session 3 - Geology 120

2:00-3:00 Teaching Style Contrasts (Leedham, Podendorf)

* * *

June 25 Friday

*Session 1 - Education 201

9:00-9:30 Philosophy of the "Process Approach" (Gagne)

9:30-10:00 Behavioral Objectives (Gagne)

10:15-12:00 Child Development (Gagne)

Session 2 - Geology 106

1:30-3:30 Laboratory work with "process" materials: Formation of committees and assignments (Leedham and Podendorf)

WEEK II

June 28 Monday

*Session 1 - Education 201

9:00-10:30 "Process" In the Physical Sciences (Hoffman)

10:45-12:00 "Process" In the Earth Sciences (DeVore)

Session 2 - Geology 106

1:30-3:30 Laboratory (Leedham, Podendorf)

****

June 29 Tuesday

*Session 1 - Education 201

9:00-9:30 The New Math and Its Relationship to the "Process Approach" (Denmark)

10:45-12:00 The Process Sequence (Podendorf)

Session 2 - Geology 106

1:30-3:30 Laboratory (Leedham)

****

June 30 Wednesday

Session 1 - Geology 106

9:00-12:00 Laboratory (Leedham)

Session 2 - Geology 106

1:30-3:30 Laboratory (Leedham)

****

July 1 Thursday

Session 1 - Geology 106

8:45-10:15 History and Philosophy of Science (Allen)

10:30-12:00 Laboratory (Leedham)

Session 2 - Geology 106

1:30-3:30 Laboratory (Leedham)

****

July 2 Friday

Session 1 - Geology 106

8:45-10:15 History and Philosophy of Science (Allen)

10:30-12:00 Laboratory (Leedham)

WEEK III

July 5 Monday

Session 1 - Geology 106

8:45-10:15 Biology Content (Allen)

10:30-12:00 Laboratory (Leedham)
(Payment of final stipend)

*Session 2 - TBA

1:30-3:30 Teaching practicum (Leedham)
(Individual instructors will work with elementary students while the rest observe. Teaching performance will be critiqued by observers)

****

July 6 Tuesday

Session 1 - Geology 106

8:45-10:15 Biology Content Lecture (Allen)

10:30-12:00 Laboratory (Leedham)

*Session 2 - TBA

1:30-3:30 Teaching Practicum

****

July 7 Wednesday

Session 1 - Geology 106

8:45-10:15 Biology Content Lecture (Allen)

10:30-12:00 Laboratory (Leedham)

*Session 2 - TBA

1:30-3:30 Teaching Practicum

****

July 8 Thursday

Session 1 - Geology 106

8:45-10:15 Force (Herron)

10:30-12:00 Mass and Weight (Schwartz)

*Session 2 - TBA

1:30-3:30 Teaching Practicum

****

July 9 Friday

Session 1 - Geology 106

8:45-10:15 Rate of Change (Atwood)

10:30-12:00 Kinetic-Molecular Theory (Lepper)

WEEK IV

July 12 Monday

Session 1 - Geology 106

9:00-10:30 Spectral Analysis (Woodward)

10:45-12:00 Laboratory (Leedham)

*Session 2 - TBA

1:30-3:30 Elementary teachers work with children, instructors observe

****

July 13 Tuesday

Session 1 - Geology 106

9:00-12:00 Laboratory (Leedham)

*Session 2 - TBA

1:30-3:30 Elementary teachers work with children, instructors observe

****

July 14 Wednesday

*Session 1 - Geology 120

9:00-10:30 Developments in Science Education - Relationship to Modern Learning (Burkman)

Session 2 - Geology 106

10:45-12:00 Laboratory (Leedham)

*Session 3 - TBA

1:30-3:30 Instructors work with children, elementary teachers observe

****

July 15 Thursday

*Session 1 - Education 201

9:00-12:00 Behavioral Change and Measurement (Walbesser)

Session 2 - Geology 106

10:45-12:00 Laboratory (Leedham)

*Session 3 - TBA

1:30-3:30 Instructors work with children, elementary teachers observe

****

July 16 Friday

Session 1 - Geology 106

9:00-10:30 Laboratory (Leedham)

10:45-12:00 Evaluation (Walbesser)

WEEK V

July 19 Monday

Session 1 - Geology 106

9:00-12:00 Problems of Center Administration and Management (Brakken)

*Session 2 - Geology 106 and other areas TBA

1:30-3:30 Laboratory (Leedham)
(Tutorial experiences with children, observation of AAAS in regular classrooms, instructors work with elementary teachers, administration of checklist, and process measure)

****

July 20 Tuesday

*Session 1 - Geology 106 and other areas TBA

9:00-3:30 Tutorial experiences with children, observation of AAAS in regular classrooms, instructors work with elementary teachers, administration of checklist, and process measure, course planning

****

July 21 Wednesday

*Session 1 - Geology 106 and other areas TBA

9:00-3:30 Tutorial experiences with children, observation of AAAS in regular classrooms, instructors work with elementary teachers, administration of checklist and process measure, course planning

****

July 22 Thursday

Session 1 - Geology 106 and other areas TBA

9:00-12:00 Tutorial experiences with children, observation of AAAS in regular classrooms, instructors work with elementary teachers, administration of checklist and process measure, course planning

Session 2 - Geology 106

1:00-3:00 Testing (Brakken)

****

July 23 Friday

Session 1 - Geology 106

9:00-12:00 Review and evaluation of summer workshop, final plans for implementation of instructional centers (Brakken, Leedham)

Roster of Summer Workshop Participants

Donald L. Abraham 3730 Belle Vista Drive St. Petersburg Beach, Florida	Northesast High School 5500 16th Street North St. Petersburg, Florida
Carl A. Babski 6076 West 14th Court Hialeah, Florida	Miami-Dade Junior College 11380 N.W. 27th Avenue Miami, Florida 33167
William Bell 5290 48th Avenue, North St. Petersburg, Florida	St. Petersburg Senior High School St. Petersburg, Florida
William N. Brown 2006 South Fern Circle Leesburg, Florida	Lake-Sumter Junior College Leesburg, Florida
John Bullock 2911 Chapin Street Tampa, Florida	Robinson High School 6311 S. Lois Avenue Tampa, Florida 33616
Harold G. Campbell 2640 Wilson Street Hollywood, Florida	Miami-Dade Junior College 11380 N.W. 27th Avenue Miami, Florida 33167
Floyd H. Clark 805 S. Lakeview Drive Sebring, Florida 33870	Board of Public Inst. Sebring, Florida 33870
James W. Cooper 939 Carlton Avenue Lake Wales, Florida	Spook Hill Elementary Lake Wales, Florida
Betsy A. Conlon (Miss) 2517 Palm Drive Tampa, Florida	Madison Junior High Tampa, Florida
James B. Fleek 518 Patricia Lane Jacksonville, Florida 32050	Jacksonville University Jacksonville, Florida
Jon Fortman 5103 Karl Place Orlando, Florida	Maynard Evans High School 4949 Silver Star Road Orlando, Florida

Roster of Summer Workshop Participants (cont.)

Frances J. Jones (Mrs.) 2731 S.W.Williston Road Gainesville, Florida	Westwood Junior High 1338 N.W. 31st Terrace Gainesville, Florida
Michael T. Kambour 2240 S.W. 80th Court Miami, Florida	Miami-Dade Junior College 11380 N.W. 27th Avenue Miami, Florida 33167
Edmund J. Leddy, Jr. 2460 N.W. 103rd Street Miami, Florida	Miami-Dade Junior College 11380 N.W. 27th Avenue Miami, Florida 33167
Lyle L. Lowry 233 North Lakeland Avenue Orlando, Florida 32805	Edgewater High School Orlando, Florida
Carl E. Martin 1571 N.E. 42nd Street Pompano Beach, Florida	Pompano Beach Senior High 1400 N.E. Sixth Street Pompano Beach, Florida
Roger Mott 604 Chaseville Street Pensacola, Florida	Board of Public Instruction 215 West Garden Street Pensacola, Florida 32502
Ellen G. Nelms (Mrs.) 6101 Coconut Terrace Plantation, Florida	Junior College of Broward Co. 3501 South west Davie Road Fort Lauderdale, Florida
Hans Schneider 1433 Stanley Lane Eau Gallie, Florida	Eau Gallie High School 1400 Stewart Road Eau Gallie, Florida
Don Self 1900 Wisteria Street Sarasota, Florida	Board of Public Instruction 4850 Lords Avenue Sarasota, Florida 33581
Bernice C. Shor (Miss) 1004 Vassar Avenue Orlando, Florida	Rollins College Winter Park, Florida
Robert Westbrook 1424 Victoria Drive West Palm Beach, Florid	Forest Hill High School 6901 Parker Avenue West Palm Beach, Florida
Janet Whitman (Miss) 2812 Forest Lane Sarasota, Florida 33581	Sarasota High School Sarasota, Florida

Roster of Summer Workshop Participants (cont.)

John D. Woolever 2250 Worrington Street Sarasota, Florida	Riverview High School 4850 Lords Avenue Sarasota, Florida 33581

Outline of Institute Program for Teachers - Summer, 1965

The AAAS Summer Institute for Elementary Teachers Schedule

WEEK I

June 21 Monday

*Session 1 - Education 201

8:00-8:15 Welcome and Introductions (Brakken)

8:15-9:00 AAAS "Process Approach" teaching demonstration (Leedham)

Session 2 - Geology 305

9:30-11:00 Discussion of demonstration and introduction of "Process Approach" General Orientation (Brakken, Leedham)

11:00-11:45 Registration

Session 3 - Geology 305

1:30-2:30 Overview of the Summer Institute (Pierce) (Initial stipend check)

2:45-3:30 Discussion of the AAAS Dissemination Project for the State of Florida (Brakken)

****

June 22 Tuesday

*Session 1 - Geology 120

9:00-10:15 New Science Curricula (Marshall)

10:30-12:00 The AAAS "Process Approach" - History and Development (Kurtz)

Session 2 - Geology 305

1:30-3:30 Testing (Brakken,Pierce)

****

* Combined Institute and Workshop groups

Appendix E-2

June 23 Wednesday

Session 1 - Geology 305

9:00-12:00 The Biological Sciences in the "Process Approach" (Kurtz)

*Session 2 - Math-Meteorology 101

1:30-3:30 History and Evolution of the Elementary School Science (Podendorf)

****

June 24 Thursday

*Session 1 - Education 201

9:00-10:00 The"Process Approach": Definition and Rationale (Kurtz)

10:15-12:00 A Learning Hierarchy (Gagne)

*Session 3 - Geology 120

2:00-3:00 Teaching Style Contrasts (Leedham, Podendorf)

****

June 25 Friday

*Session 1 - Education 201

9:00-9:30 Philosophy of the "Process Approach" (Gagne)

9:30-10:00 Behavioral Objectives (Gagne)

10:14-12:00 Child Development (Gagne)

Session 2 - Geology 305

1:30-3:30 Laboratory (Pierce)

WEEK II

June 28 Monday

*Session 1 - Education 201

9:00-10:30 "Process" in the Physical Sciences (Hoffman)

10:45-12:00 "Process" in the Earth Sciences (DeVore)

Session 2 - Geology 305

1:30-3:30 Laboratory (Pierce)

****

June 29 Tuesday

*Session 1 - Education 201

9:00-9:30 The New Math and Its Relationship to the "Process Approach" (Denmark)

10:45-12:00 The Process Sequence (Podendorf)

Session 2 - Geology 305

1:30-3:30 Laboratory (Pierce)

****

June 30 Wednesday

Session 1 - Geology 305

9:00-12:00 Laboratory (Pierce)

Session 2 - Geology 305

1:30-3:30 Laboratory (Pierce)

****

July 1 Thursday

Session 1 - Geology 305

8:45-10:15 Laboratory (Pierce)

10:30-12:00 History and Philosophy of Science (Allen)

Session 2 - Geology 305

1:30-3:30 Laboratory (Pierce)

****

July 2 Friday

Session 1 - Geology 305

8:45-10:15 Laboratory (Pierce)

10:30-12:00 History and Philosophy of Science (Allen)

WEEK III

July 5 Monday

Session 1 - Geology 305

8:45-10:15 Laboratory (Pierce)

10:30-12:00 Biology Content (Allen)

*Session 2 - TBA

1:30-3:30 Teaching Practicum
(Teachers use materials with elementary students)

****

July 6 Tuesday

Session 1 - Geology 305

8:45-10:15 Laboratory (Pierce)

10:30-12:00 Biology Content Lecture (Allen)

*Session 2 - TBA

1:30-3:30 Teaching Practicum

****

July 7 Wednesday

Session 1 - Geology 305

8:45-10:15 Laboratory (Pierce)

10:30-12:00 Biology Content Lecture (Allen)

*Session 2 - TBA

1:30-3:30 Teaching Practicum

****

July 8 Thursday

Session 1 - Geology 305

8:45-10:15 Mass and Weight (Schwartz)

10:30-12:00 Force (Herron)

*Session 2 - TBA

1:30-3:30 Teaching Practicum

****

July 9 Friday

Session 1 - Geology 305

8:45-10:15 Kinetic-Molecular Theory (Lepper)

10:30-12:00 Rate of Change (Atwood)

WEEK IV

July 12 Monday

Session 1 - Geology 305

9:00-12:00 Laboratory (Pierce)

*Session 2 - TBA

1:30-3:30 Elementary teachers work with materials and children, instructors observe and critique

****

July 13 Tuesday

Session 1 - Geology 305

9:00-10:30 Spectral Analysis (Woodward)

10:45-12:00 Laboratory (Pierce)

*Session 2 - TBA

1:30-3:30 Elementary teachers work with materials and children, instructors observe and discuss lesson

****

July 14 Wednesday

*Session 1 - Geology 120

9:00-10:30 Developments in Science Education - Relationship to Modern Learning Theory (Burkman)

*Session 2 - Geology 305

10:45-12:00 Laboratory (Pierce)

*Sessions 3 - TBA

1:30-3:30 Instructors work with materials and children, elementary teachers observe and discuss

****

July 15 Thursday

*Session 1 - Education 201

9:00-12:00 Behavioral Change and Measurement (Walbesser)

*Session 2 - TBA

1:30-3:30 Instructors work with children, elementary teachers observe and discuss lesson

****

July 16 Friday

Session 1 - Geology 305

9:00-10:30 Evaluation (Walbesser)

10:45-12:00 Laboratory (Pierce)

WEEK V

July 19 Monday

Session 1 - Geology 305

9:00-12:00 Use and Storage of Equipment (Pierce)

*Session 2 - Geology 305 and additional space

1:30-3:30 Laboratory (Pierce)
(Tutorial experiences with children, obervation of AAAS in regular classrooms, instructors work with elementary teachers, administration of checklist and process measures)

****

July 20 Tuesday

*Session 1 - TBA

9:00-3:30 Tutorial experiences with children, observation of AAAS in regular classrooms, instructors work with elementary teachers, administration of checklist and process measures, course planning

****

July 21 Wednesday

*Session 1 - TBA

9:00-3:30 Tutorial experiences with children, observation of AAAS in regular classrooms, instructors work with elementary teachers, administration of checklist and process measures, course planning

****

July 22 Thursday

*Session 1 - TBA

9:00-12:00 Tutorial experiences with children, observation of AAAS in regular classrooms, instructors work with elementary teachers, administration of checklist and process measures, course planning

Session 2 - Geology 305

1:30-3:30 Testing (Pierce, Brakken)

****

July 23 Friday

Session 1 - Geology 305

9:00-10:00 Organization, clean up of materials (Pierce)

10:15-12:00 Critique and Evaluation of the Summer Institute (Pierce)

Roster of Adjunct Professors, Assistants, and Places Taught

CENTER	MEETING TIME & PLACE	INSTRUCTOR	ASSISTANT INSTRUCTOR
Belle Glade	Gladeview Elementary School S. W. 10th Street Belle Glade, Florida Thursdays - 4:30 to 7:30	Mr. Bob Westbrook 1424 Victoria Drive West Palm Beach, Florida 965-4354	Mrs. Mercedes Robinson Lake Shore Elementary School 1102 S. W. Avenue A Belle Glade, Florida
Bradenton	Room 119-120 Bayshore Junior High School 5323 34th Street W Bradenton, Florida Thursdays - 6:30 to 9:30	Mr. Don Self 1900 Wisteria Street Sarasota, Florida 958-6466	Mr. William Aldrich Science Consultant P. O. Box 2069 Bradenton, Florida
Clearwater	Largo Central Elementary School 250 First Avenue N. E. Largo, Florida Mondays - 7:00 to 10:00	Mr. William A. Bell 5290 48th Avenue N St. Petersburg, Florida 526-6175	Mrs. Jane Fels Elementary Consultant P. O. Box 719 Clearwater, Florida
Cocoa	Room B 110 Brevard Junior College Cocoa, Florida Thursdays - 7:00 to 10:00	Mr. Jon R.Fortman 5103 Karl Place Orlando, Florida 295-3377	Mr. Gordon Crouch Elementary Coordinator Brevard County Box 5 Titusville, Florida
Gainesville	Room 16 Westwood Junior H. S. Gainesville, Florida Thursdays - 6:00 to 9:00	Mrs. Francis Jones 2731 S. W. Williston Gainesville, Florida 372-3483 or 376-8367	Mr. Richard Dillard Gainesville, Florida

Appendix F-2

CENTER	MEETING TIME & PLACE	INSTRUCTOR	ASSISTANT INSTRUCTOR
Hialeah	Room 1259 Miami-Dade Junior College 11380 N. W. 27th Avenue Miami, Florida Mondays - 7:00 to 10:00	Mr. Harold Campbell Miami-Dade Junior College 11380 N. W. 27th Avenue Miami, Florida 688-3541 - Ext. 285	Mrs. Harriett Ehrhard Special Science Teacher Dade County Schools 1410 N. E. Second Avenue Miami, Florida
Jacksonville	Room 2 Swisher Science Building Jacksonville University Jacksonville, Florida Tuesdays - 7:00 to 10:00	Mr. James B. Fleek Jacksonville University Jacksonville, Florida 725-0911 - Ext. 252	Mr. James H. Scroggins Elementary Supervisor 11011 Gilmore Street Jacksonville, Florida
Lake Wales	Spook Hill Elementary School 321 East North Avenue Lake Wales, Florida Tuesdays - 4:30 to 7:30	Mr. James Cooper Spook Hill Elementary 321 East North Avenue Lake Wales, Florida 3-4981	Mrs. Evelyn Hughes Science Supervisor Winter Haven Senior High Six Street S. E. Winter Haven, Florida
Lake Worth	Science 18 & 19 Palm Beach Junior College West Palm Beach, Florida Tuesdays - 6:30 to 9:30	Mr. Carl E. Martin Pompano Beach S.H.S. 1400 N. E. 6th Street Pompano Beach, Florida	Mr. Paul Geber Pompano Beach Senior High School 700 N. E. 13th Avenue Pompano Beach, Florida
Leesburg	Room C-7 and C-8 Lake-Sumter Junior College Leesburg, Florida Wednesdays - 6:30 to 9:30	Mr. William N. Brown Lake-Sumter Junior College Leesburg, Florida 787-3747	Mr. Ned Richardson Rimes Elementary School Leesburg, Florida
Melbourne	Eau Gallie High School Room D-12 1400 Stewart Road Eau Gallie, Florida Tuesdays - 7:00 to 10:00	Mr. Hans Schneider 1433 Stanley Lane Eau Gallie, Florida 254-8572	Mr. Earl Benton Harbor City Elementary Sarno Road Eau Gallie, Florida

Appendix F-3

CENTER	MEETING TIME & PLACE	INSTRUCTOR	ASSISTANT INSTRUCTOR
Miami North	Room 1259 Miami-Dade Junior College 11380 N. W. 27th Avenue Miami, Florida Tuesdays - 7:00 to 10:00	Mr. Edmund Leddy Miami-Dade Junior College 11380 N. W. 27th Avenue Miami, Florida 688-3541	Mr. Stewart Darrow Science Supervisor Dade County 1410 N. E. Second Avenue Miami, Florida
Miami South	Southwest Senior H. S. 8855 S. W. 50th Terr. Miami, Florida Wednesdays - 7:00 to 10:00	Mr. Michael T. Kambour 2240 S. W. 80th Court Miami, Florida 221-6377	Mr. Howard N. Winniman Ojus Elementary School 18600 W. Dixie Highway North Miami Beach, Florida
Naples	Sea Gate Elementary School Naples, Florida Thursdays - 7:00 to 10:00	Mr. John Bullock 2911 Chapin Avenue Tampa, Florida	Mrs. Paula Odom Immokolee School Immokolee, Florida
Orlando	Room 525 - Knowles Rollins College Winter Park, Florida Tuesdays - 7:00 to 10:00	Miss Bernice C. Shor 1004 Vassar Avenue Orlando, Florida 425-7938	Mrs. Nancy Connell Elementary Supervisor Orange County Public Schools Box 271 Orlando, Florida
Pensacola	School Board Office Materials Center 215 Garden Street Pensacola, Florida Tuesdays - 5:30 to 8:30	Mr. Roger C. Mott Escambia County Board of Public Instruction Pensacola, Florida	Mr. Don Hand Escambia High School 1310 N. 65tn Avenue Pensacola, Florida
Punta Gorda	Peace River Elementary School 641 N. W. Hancock Charlotte Harbor, Florida Wednesdays - 5:30 to 8:30	Mr. Floyd H. Clark 805 S. Lakeview Dr. Sebring, Florida LV 5-8481	Mr. John A. Peel Punta Gorda, Florida

Appendix F-4

CENTER	MEETING TIME & PLACE	INSTRUCTOR	ASSISTANT INSTRUCTOR
St. Petersburg	Northwest Elementary School 5601 22nd Avenue N St. Petersburg, Florida Thursdays - 7:00 to 10:00	Mr. Donald L. Abraham 3730 Belle Vista Drive St. Petersburg, Florida 360-7453	Mr. William E. Beggs Supervisor of Science Pinellas County P. O. Box 719 Clearwater, Florida
Sarasota	Marine Laboratory Riverview High School 4850 Lords Lane Sarasota, Florida Tuesdays - 6:00 to 9:00	Mr. John D. Woolever Science Supervisor 2418 Hatton Street Sarasota, Florida	Mrs. Jean Matheson Supervisor - Sarasota County 2418 Hatton Street Sarasota, Florida
Sarasota - Bradenton	Room N - 101 Sarasota High School 1001 S. Washington Blvd. Sarasota, Florida Wednesdays - 6:30 to 9:30	Miss Janet Whitman 2812 Forest Lane Sarasota, Florida 924-1611	Mrs. Joseph A. Barows Venice Elementary School Rt. 1, Box 170 Nakomis, Florida
Tampa	Madison Junior High School Room 40 4444 Bay Vista Avenue Tampa, Florida Wednesdays - 6:00 to 9:00	Miss Betsey A. Conlon 2517 Palm Drive Tampa, Florida 252-5121	

Appendix G-1

Roster of Teachers in Each Treatment Group

TREATMENT GROUP I (Summer Institute)

Grade 1

Mrs. Baronese Bynum
Holden Street Elementary School
P. O. Box 5006
Orlando, Florida 32805

Mrs. Dorothy L. Cleland
Royal Palm Elementary School
4200 S. W. 112th Court
Miami, Florida 33165

Miss Lois A. Colussy
Azalea Elementary School
1680 74th Street, North
St. Peterburg, Florida

Mrs. Marian C. Hodges
San Jose #83 Elementary School
5805 Old St. Augustine Road
Jacksonville, Florida

Mrs. Edwina F. Meeks
George M. Lynch Elementary School
1901 71st Avenue, North
St. Petersburg, Florida

Grade 2

Miss Cecile Ashmore
Silver Bluff Elementary School
2609 S. W. 25th Avenue
Miami, Florida

Mrs. Clytie M. Brown
Rimes Elementary School
P. O. Box 177
Leesburg, Florida

Mrs. Grace Coughlin
John G. DuPuis Elementary School
1150 W. 59th Place
Hialeah, Florida

Mrs. Margaret Finnegan
Oldsmar Elementary School
P. O. Box K
Oldsmar, Florida 33557

Mrs. Marilyn Gless
Ensley Elementary School
Route 3, Box 473
Pensacola, Florida

Grade 3

Miss Barbara Colbert
South Seminole Elementary School
451 S. Winter Park Drive
Casselberry, Florida

Mrs. Annie J. Duncan
W. Pensacola Elementary School
801 N. 49th Avenue
Pensacola, Florida 32506

Mrs. Maxine Gould
Golfview Elementary School
1530 S. Fiske Boulevard
Rockledge, Florida 32955

Miss Alice J. Kessinger
W. E. Cherry Elementary School
Edson Drive
Orange Park, Florida

Miss Janet Lachenmyer
Orange Grove Elementary School
10300 65th Avenue, North
Largo, Florida

Appendix G-2

Roster of Teachers in Each Treatment Group

TREATMENT GROUP I (Summer Institute)

Grade 1

Mrs. Maxie Sullivan
Garden City Elementary School
2814 Dunns Avenue
Jacksonville, Florida

Mrs. Phyllis Sutter
South Ocala Elementary School
2409 Lake Weir Avenue
Ocala, Florida

Mrs. Mary T. Towers
Alachua Elementary School
P. O. Box 68
Alachua, Florida 32615

Miss Jane Varner
Edgewater Elementary School
100 Boeing Street
Pensacola, Florida

Grade 2

Miss Shirley Hines
Garden City Elementary School
2814 Dunns Avenue
Jacksonville, Florida

Mrs. Patricia Hollis
Parkwood Heights Elementary
1709 Lansdawne
Jacksonville, Florida

Mrs. Violet Leonard
Bellview Elementary School
Route 8, Box 82
Pensacola, Florida

Mrs. Lillian Neasman
Dabney Elementary School
Leesburg, Florida

Miss Sonya O. Shipman
South Hialeah Elementary School
265 East 5th Street
Hialeah, Florida

Grade 3

Mrs. Isabella Lennon
Harris Elementary School
4600 Haines Road
St. Petersburg, Florida

Mrs. Sarah L. Noblin
McDavid Elementary School
McDavid, Florida

Mrs. W. C. Pitcock
Venice Elementary School
Milan Avenue & Bahama Street
Venice, Florida 33595

Mrs. Patricia Witt
Myra Terwillinger Elementary School
301 N. W. 62nd Street
Gainesville, Florida

Roster of Teachers in Each Treatment Group

TREATMENT GROUP II (In-Service Institute)

Grade 1

Mrs. Mildred Bigham
Lee Elementary School
Leesburg, Florida

Mrs. Estella B. Bloch
Scott Lake Elementary School
1160 N. W. 175th Street
Miami, Florida

Mrs. Charlotte R. Doyle
Scenic Heights Elementary School
3801 Cherry Laurel Drive
Pensacola, Florida

Mrs. Marie F. Kelly
Cape View Elementary School
8440 N. Rosalind
Cape Canaveral, Florida

Mrs. Beatrice Kramer
Mims Elementary School
North U. S. Highway
Mims, Florida

Grade 2

Mrs. Joan B. Charlton
Orange Ridge Elementary School
400 30th Avenue W
Bradenton, Florida

Mrs. Rebecca W. Green
Greynolds Park Elementary School
1536 N. W. 179th Street
North Miami, Florida

Mrs. Meri T. Hegler
Ludlam Elementary School
6639 S. W. 74th Street
Miami, Florida

Mrs. Doris Hinson
North Ward Elementary School
900 N. Fort Harrison
Clearwater, Florida

Miss Sara Little
South Lake Elementary School
Garden Street
Titusville, Florida

Grade 3

Mrs. Oliva K. Clark
Kings Highway Elementary School
1715 Kings Highway
Clearwater, Florida

Mrs. Emma Clifton
Newberry High School
Newberry, Florida

Mrs. June A. Crane
Jessie P. Miller Elementary School
4201 Manatee Avenue W
Bradenton, Florida

Mrs. Barbara Kennedy
Fort Caroline Elementary School
10528 Lakeview Road E
Jacksonville, Florida

Mrs. Ann D. Manucy
Golfview Elementary School
1530 Fiske Boulevard
Rockledge, Florida

Appendix G-4

Roster of Teachers in Each Treatment Group

TREATMENT GROUP II (In-Service Institute)

Grade 1

Mrs. Rena Roberts
Kirby Smith Elementary School
607 E. University Avenue
Gainesville, Florida

Mrs. Cornelia K. Robinson
Spencer Bibbs Elementary School
2005 N. 6th Avenue
Pensacola, Florida

Miss Sandra Smothers
Garden City Elementary School
2814 Dunns Avenue
Jacksonville, Florida

Mrs. Barbara Stephens
Brentwood Elementary School
2500 Vinson Avenue
Sarasota, Florida

Mrs. Marsha Williams
Northwest Elementary School
5601 22nd Avenue N
St. Petersburg, Florida

Grade 2

Mrs. Mildred Marshall
Woodland Acres Elementary School
328 Bowland Street
Jacksonville, Florida

Miss Judith Straight
Lancaster Elementary School
6700 Sheryl Ann Drive
Orlando, Florida

Mrs. Carolyn Tavel
Dover Shores Elementary School
1200 Gaston Forest Road
Orlando, Florida

Miss Mae Vaughn
Alachua Elementary School
Alachua, Florida 32615

Mrs. Blanche Zerke
W. Pensacola Elementary School
801 N. 49th Avenue
Pensacola, Florida

Grade 3

Miss Theresa Nigro
Fairlawn Elementary School
444 S. W. 60th Avenue
Miami, Florida

Miss Mary Page
Minneola Elementary School
P. O. Box 488
Minneola, Florida

Mrs. Gladys L. Stephens
A. K. Suter Elementary School
2900 E. Strong Street
Pensacola, Florida

Miss Nancy L. Thigpen
Bay Vista Elementary School
5900 9th Street South
St. Petersburg, Florida

Mrs. Ruth Thompson
Killarney Elementary School
Wellington Boulevard
Winter Park, Florida

Appendix G-5

Roster of Teachers in Each Treatment Group

TREATMENT GROUP III (Materials Only)

Grade 1

Mrs. Edna Ahlers
Palmetto Elementary School
12401 S. W. 74th Avenue
Miami, Florida

Mrs. Mary Bessent
Merrill Road School
8239 Merrill Road
Jacksonville, Florida

Miss Chlorene Blades
Nokomis Elementary School
P. O. Box 485
Nokomis, Florida

Mrs. Sandra H. Finck
Pasadene Elementary School
7121 Central Avenue
St. Petersburg, Florida

Miss Barbara Johnson
Nokomis Elementary School
P. O. Box 485
Nokomis, Florida

Grade 2

Mrs. Lee Baggett
Central Riverside School
2555 Gilmore Street
Jacksonville, Florida

Mrs. Lois Craven
Seminole Elementary School
121 S. W. 78th Place
Miami, Florida

Miss Pamela Crawford
Northwest Elementary School
5601 22nd Avenue N
St. Petersburg, Florida

Mrs. Alfreda Golay
A. K. Suter Elementary School
2900 E. Strong Street
Pensacola, Florida

Mrs. Flora Hill
Rimes Elementary School
Leesburg, Florida

Grade 3

Mrs. W. D. Ballenger
Scenic Heights Elementary School
3801 Cherry Laurel Drive
Pensacola, Florida

Mrs. Lou Don Bates
Nokomis Elementary School
P. O. Box 485
Nokomis, Florida

Mrs. Leslie K. Ferris
Largo Central Elementary School
250 1st Avenue, N E
Largo, Florida

Mrs. Ruth Gary
Key Biscayne Elementary School
150 W. McIntire
Key Biscayne, Florida

Mrs. Nada V. Hackett
San Mateo Elementary School
600 Baisden Road
Jacksonville, Florida

Roster of Teachers in Each Treatment Group

TREATMENT GROUP III (Materials Only)

Grade 1

Mrs. Nina Lisenby
Lake Lucina School
6527 Merrill Road
Jacksonville, Florida

Mrs. Helen Ann Moore
George M. Lynch Elementary School
1901 71st Avenue, N
St. Petersburg, Florida

Mrs. Hellen O. Morrison
Nokomis Elementary School
P. O. Box 485
Nokomis, Florida

Miss Peggy Shannon
2747 Charemont Circle
Jacksonville, Florida

Miss Carol Sherman
Nokomis Elementary School
P. O. Box 485
Nokomis, Florida

Grade 2

Miss Jean Landers
Englewood Elementary School
250 S. Perry Street
Englewood, Florida

Mrs. Marietta McCurry
Madie Ives Elementary School
20770 N. E. 14th Avenue
North Miami, Florida

Mrs. Lillith McDowell
Lake Lucina School
6527 Merrill Road
Jacksonville, Florida

Mrs. Linda Silverman
Dover Shores Elementary School
1200 Gaston Forest Road
Orlando, Florida

Mrs. Essie M. Stewart
Memorial Elementary School
P. O. Box 585
Palmetto, Florida

Grade 3

Miss Christa Kinzy
P. K. Yonge Laboratory School
University of Florida
Gainesville, Florida

Mrs. Betty Koppen
Scott Lake Elementary School
1160 N. W. 175th Street
Miami, Florida

Mrs. Ina Marshall
Jim Allen Elementary School
Box 585
Cantonment, Florida

Miss Eloise Mitchell
Nokomis Elementary School
P. O. Box 485
Nokomis, Florida

Mrs. Ellen Monroe
Howard Drive Elementary School
7750 S. W. 136th Street
Miami, Florida

Roster of Teachers in Each Treatment Group

TREATMENT GROUP IV (Control)

Grade 1	Grade 2	Grade 3
Mrs. Mabel Armbruster Bear Creek Elementary School 360 61st Street St. Petersburg, Florida	Mrs. Frances Abbott N. B. Cook Elementary School 1100 E. Cervantes Pensacola, Florida	Mrs. Celia M. Cone Seabreeze Elementary School 1400 Seabreeze Avenue Jacksonville Beach, Florida
Miss Dorothy Blackwell Scott Lakes Elementary School 1160 N. W. 175th Street Miami, Florida	Miss Carol Anderson Hungerford Elementary School Route 2, Box 809 Maitland, Florida	Mrs. Minnie Gray Woodlawn Elementary School 16th Street and 17th Avenue St. Petersburg, Florida
Mrs. Lucille Fletcher Daughtrey Elementary School 515 63rd Avenue East Bradenton, Florida	Mrs. Carolyn Conn Earnest Ward Elementary School Route 1, Box 156 Atmore, Alabama	Miss Hope Beverly Shores Elementary School Leesburg, Florida
Mrs. Barbara A. Hoffman Palmetto Elementary School 719 9th Avenue Palmetto, Florida	Mrs. Dorothy Davenport Greynolds Park Elementary School 1536 N. W. 179th Street North Miami, Florida	Mrs. Robin Karnes Samoset Elementary School P. O. Box 428 Samoset, Florida
Mrs. Silvia Leiter Seminole Elementary School 121 S. W. 78th Place Miami, Florida	Mrs. Amanda May Ludlam Elementary School 6639 S. W. 74th Street Miami, Florida	Mrs. Anna Linder Norland Elementary School 19340 N. W. 8th Court Miami, Florida

Appendix G-8

Roster of Teachers in Each Treatment Group

TREATMENT GROUP IV (Control)

Grade 1

Mrs. Flora Medvetz
Oneco Elementary School
Box 668
Oneco, Florida

Mrs. Jeannie B. Prince
San Jose Elementary School
5805 Old St. Augustine Road
Jacksonville, Florida

Mrs. Ernestine Sexton
W. Central Elementary School
700 25th Street North
St. Petersburg, Florida

Mrs. Betty Ward
Oliver J. Semmes Elementary School
1250 Texar Drive
Pensacola, Florida

Mrs. Maureen Yeager
South Lake Elementary School
W. Garden Street
Titusville, Florida

Grade 2

Mrs. Bonnie McDade
Skyview Elementary School
8601 60th Street N
Pinellas Park, Florida

Miss Shirley Putnam
Gulfview Elementary School
1530 Fiske Boulevard
Rockledge, Florida

Miss Starkey
Lee Elementary School
Leesburg, Florida

Mrs. Nicey A. Tillman
Memorial Elementary School
P. O. Box 585
Palmetto, Florida

Mrs. Esstoya Whitley
P. K. Yonge Laboratory School
University of Florida
Gainesville, Florida

Grade 3

Mrs. Peggy Long
Dover Shores Elementary School
Orlando, Florida

Miss Carolyn Meigs
Idlewild Elementary School
4601 S. W. 20th Terrace
Gainesville, Florida

Miss Martha Rand
Cape View Elementary School
8440 Rosalind Avenue
Cape Canaveral, Florida

Mrs. Mary Shatzman
North Shore Elementary School
35th Avenue & Oak Street N E
St. Petersburg, Florida

Miss Talbot
Edgewater Elementary School
Edgewater, Florida

Roster of Observers for Classroom Interaction

Mr. William Aldrich
Science Consultant
P. O. Box 2069
Bradenton, Florida

Dr. Boyd Ayers
Supervisor of Guidance Service
Alachua County Public Schools
Gainesville, Florida

Mr. William E. Beggs
Supervisor of Science
Pinellas County
P. O. Box 719
Clearwater, Florida

Mrs. Nancy Connell
Elementary Supervisor
Orange County Public Schools
Box 271
Orlando, Florida

Mr. Gordon Crouch
Elementary Coordinator
Brevard County
Box 5
Titusville, Florida

Mr. Stewart Darrow
Science Supervisor
Dade County
1410 N. E. Second Avenue
Miami, Florida

Mrs. Harriett Ehrhard
Special Science Teacher
Dade County Schools
1410 N. E. Second Avenue
Miami, Florida

Mrs. Jane Fels
Elementary Consultant
P. O. Box 719
Clearwater, Florida

Mrs. Dorothy Gregory
Dade County Elementary
Science Supervisor
Miami, Florida

Mrs. Bobbie C. Hathorn
438 Fairpoint Drive
Gulf Breeze, Florida

Mr. Charles B. Hathorn
Escambia County Testing Coordinator
Pensacola, Florida

Miss Jeannette Matheson
Director of Elementary Education
2418 Hatton Street
Sarasota, Florida

Mr. Buford Robinson, Consultant
Mathematics and Science Education
P. O. Box 357
Tavares, Florida

Mr. James H. Scroggins
Elementary Supervisor
1011 Gilmore Street
Jacksonville, Florida

Mrs. Evelyn Stack
County Coordinator of Tests and
Measurements
1011 Gilmore Street
Jacksonville, Florida

Appendix I-1

Roster of Persons Who Administered the "Process Measures"

TESTING CENTER	TESTER
Bradenton	Dotterweich, A. C.
	Marshall, George A.
	Nolan, Dan
	Wakeland, Frances
Clearwater - St. Petersburg	Binning, Lilan
	Clark, Mrs. Jacque
	Griffith, Zemla
	Krieuer, Martha O.
	Runge, Ethelyn
	Rutland, Ann A.
	Saunders, Mrs. Harry
	Whitman, Betsey S.
Cocoa	Anderson, Margaretta
	Huckabay, Mildred
Gainesville	Lenahan, Margaret
	Moore, Hattilu M.
	Peek, Ruth C.
	Ramey, John D.
Jacksonville	Brown, Janice W.
	Linsenby, Nind S.
	Mann, George E.
	Marshall, Mildred H.
	Sprengling, Olivan
	Stephens, Yvonne F.
	Threatt, Robert A.
	Thompson, Francis C., Jr.
Miami - Hialeah	Ferrante, Donna Jean
	Owind, Barbara
	Pettit, Vicky Lynn
	Ries, Wesley
	Rusk, Roberta
	Shropshire, Patricia
	Small, Tiffany Kaye
	Spring, Gail
	Worley, Susan Meredith

Appendix I-2

TESTING CENTER	TESTER
Orlando	Clark, Cathy
	DeVane, Betty
	Nix, Pearl
	Thomason, Mary
Pensacola	Beck, Burton C.
	Bledsoe, Henrietta
	Byrd, Barbara Gayle
	Franke, Helen B.
	Parker, Elsie E.
	Streetman, Phoebe
	Whetstone, L. C.
	Woodman, Eva Mae
Tavares	Abney, Everett E.
	McGonigal, David L.
	Richardson, Ned R.
	Sanders, Myra G.
Titusville	Edwards, Catherine B.
	Lucas, Love B.

Directions Given for Administering the "Process Instrument"

THE PROCESS INSTRUMENT

Preparation of these materials was sponsored by the Commission on Science Education under a grant from the National Science Foundation to the American Association for the Advancement of Science.

Directions for Test Administration and Scoring

To achieve comparable and meaningful test results and to insure that the results form a valid basis for evaluating the total program, care must be taken by each examiner. Examiners are asked to study these directions carefully and to follow each instruction explicitly while maintaining a natural manner in dealing with the child. Practice the procedure using another examiner as the "child", and then change places with the other examiner.

For each process test, standard conditions should apply with regard to:

1. Materials used.
2. Directions and questions addressed to the child.
3. Manner in which materials are presented.
4. Method of deciding whether the child is to be scored "1" (acceptable response) or "0" (unacceptable response).
5. Time and method of recording scores. (Scoring should be immediate so that the examiner will not depend on memory in his scoring.)
6. In general, no assistance beyond the information and instructions provided in the test booklet should be given. If it is obvious that the child does not understand what is required of him, the tester may repeat the question or present an alternative phrasing.

As far ahead of time as is feasible, the child should be told that he will soon be tested (for example, in two days). He should be informed of the purposes of the tests he will be taking, and urged to do his best. It should be emphasized that the information gathered will be beneficial to him and will contribute to the improvement of science instruction. Language appropriate to the age of the child should obviously be used.

The first conversation with the tester should be a pleasant one. The child must be made to feel at ease. The tester might wish to request some demographic data (for example, full name, age, number of brothers and/or sisters) to break the ice, so to speak. It may be desirable to have a reasonably brief, interesting, but non-test related task which the child could perform. The task should probably be quite easy so as to provide a success experience.

The tester should be seated opposite the child at a table. Every effort should be made to make the physical environment as comfortable and relaxed as possible.

The child should be allowed as much freedom of movement as possible.

Efficiency is aided if the testing facilities are located close to the child's classroom.

If possible the testing should be carried out in the morning. It has been found that most primary grade children attain their maximum level of productivity during the morning hours.

Timing of the individual tasks should not prove to be a problem. When time limits are required they are specified in the tester's booklet. The sweep-second hand on a wrist or pocket watch is accurate enough for all the tests. When time limits are not specified the tester should decide what constitutes a reasonable time period. Observing the child's approach to a task and noting how rapidly he progresses should provide sufficient information to enable the tester to judge termination time.

GENERAL DIRECTIONS AND SUGGESTIONS

The following procedures and directions have been found to be helpful in administering the process instrument:

1. It is imperative that test materials not in use at any given time be removed from the child's view, in order to avoid offering either a visual or physical distraction. Every effort has been made to provide an efficient organization of material in the kits.

2. The tester should make every effort to maintain the child's confidence and willingness to respond.

3. Reinforcement of responses during the test must be carefully avoided. The tester is to remain neutral during the administration of the test questions and above all avoid any trace of negative or positive reinforcement. The child should of course be encouraged to do as well as he can, to put forth maximum effort, but feedback on specific items is not permissible. The examiner should not indicate that a particular question is answered correctly or incorrectly, or give the child the correct answers. If the child questions him, the examiner might say something like "We are moving right along, keep up the good work."

4. When a task contains several objects or groups of objects (for example, piles of paperclips or plastic disks), the tester should be very careful that the child does not disturb the grouping, thereby changing the correct answer.

5. When asking for several ways of saying or doing the same thing, a child will frequently become anxious. He feels that his first response is incorrect. The tester might say something to the effect that he just wants to find out how many different ways the child can do or say something.

6. If an "instruction" requests the child to "point" to something, but there is no response, the phrase "show me" may be used.

7. Careful attention to directions is necessary when evaluating children's performances. This is particularly true where an extended and complex verbal response is involved. Scoring directions have been made as explicit, objective, and unambiguous as possible. Subjective judgments are to be avoided. In most cases, standards for exercising judgment in scoring have been stated. Follow these procedures closely and apply them in the same way for all children.

SPECIFIC DIRECTIONS

The tester should be completely familiar with the starting points for each of the process measures for each grade level of child (these are summarized in the table at the end of these instructions). The process measure booklets contain the complete, specific, and necessary directions for each task. These are contained under the headings of "Procedure" and "Instructions to the Child". After rapport has been established, the tester will introduce a particular process measure by providing the child with a frame of reference as to the general area to be covered by the tasks. The introduction for each of the process measures is described in the following material.

Classifying Process Measure. I am going to show you some things and ask you some questions about them so that I can find out what you know about sorting things. Some of the questions will be easy, and some will be hard. I don't expect you to answer all of the questions, but of course you want to do your best.

Communicating Process Measure. I am going to show you some things and ask you some questions about them so that I can find out whether you can tell others about what you see. Some of the questions will be easy, and some will be hard. I don't expect you to answer all of the questions, but of course you want to do your best.

Inferring Process Measure. I am going to show you some things and ask you some questions about them so that I can find out if you know how to make and test inferences. Some of the questions will be easy, and some will be hard. I don't expect you to answer all of the questions, but of course you want to do your best.

Measuring Process Measure. I am going to show you some things and ask you some questions about them so that I can find out what you know about measuring things. Some of the questions will be easy, and some will be hard. I don't expect you to answer all of the questions, but of course you want to do your best.

Using Numbers Process Measure. I am going to show you some things and ask some questions about them so that I can find out how carefully you look at things around you. Some of the questions will be easy, and some will be hard. I don't expect you to answer all of the questions, but of course you want to do your best.

Predicting Process Measure. I am going to show you some equipment, data, and graphs. I will ask you questions about them to find out if you can use them to make predictions about what might happen if we did certain things. Some of the questions will be easy, and some will be hard. I don't expect you to answer all of the questions, but of course you want to do your best.

Using Space/Time Relations Process Measure. I am going to show you some things and ask some questions about them to find out what you know about shapes and other figures in space, and if you can tell time. Some of the questions will be easy, and some will be hard. I don't expect you to answer all of the questions, but of course you want to do your best.

The examiner must be familiar with the materials necessary.

DIRECTIONS FOR SCORING

The test booklet has a scoring column. Use a different test booklet for each child placing the child's name, grade, and school on the booklet. Score the test on the booklet and then give the completed form to the evaluation coordinator in your area.

All responses will be scored as either "1" to indicate an acceptable response or "0" to indicate an unacceptable response. Each task within a process measure is identified by a numeral - 1, 2, 3, and so on throughout the particular process measure. Some tasks require the child to make several responses. The various parts of a task are identified by lower case letters - a, b, c, and so on.

It is suggested that the tester record the 1 or 0 score during the process measure administration. The "total score" entry for a given task should be completed after administration of the entire process measure. If the child receives 1's for all of the parts of a task, he is to receive a 1 for the total score on that task. If a child receives a 0 on any part of a task, he is to receive 0 for the entire task. Since each task is meant to be representative of a particular behavior, the decision concerning the presence or absence of that behavior is considered to be a binary one, even though a task may have several parts. Should the child make an unacceptable response to any one of the parts of a task, he is considered not to have successfully completed that task. This is the reason for constructing the total score in the described manner. Each of the tasks is viewed as a single behavioral unit.

Schedule for Administration of the Process Instrument

(numerals indicate first and last task
to be administered at each grade level)

Process Measure	Grade 1	Grade 2	Grade 3
Classifying ----------------------	1-6	1-6	1-6
Communicating--------------------	1-8	1-12	1-14
Inferring------------------------	*	1-5	1-10
Measuring------------------------	1-24	1-24	1-24
Using Numbers--------------------	1-26	1-38	1-42
Observing------------------------	1-18	1-19	1-19
Predicting-----------------------	*	1-10	1-10
Using Space/Time Relations-------	1-35	1-39	1-39

*No tasks from this process measure are to be given to children at this grade level.

Samples of Items from the "Process Instrument", Observing and Using Space/Time Relations

OBSERVING PROCESS MEASURE

Item	Score	Procedure	Instructions to the Child	Acceptable Response
1 a	____	The tester places the card with the red and green disks from 0-1 on the table in front of the child.	Put your finger on the object which is different from the other two. (Allow about 15 seconds for response.)	The child should point to the green disk.
b	____	The tester points his finger at the object selected by the child.	Why did you point to this object?	The child should verbally indicate the disk he selected is a different color from the other two.
c	____	The tester points to the red disk on the left side of the card.	What color is this?	Red, red-orange, orange-similar combinations of words which include red is acceptable.
d	____	The tester points to the green disk.	What color is this?	Green.
e	====	The tester places the card with the blue triangles and rectangle on the table and points to one of the triangles.	What color is this?	Any shade of blue is acceptable.
T	____			

Appendix K-2

Samples of Items from the "Process Instrument", Observing and Using Space/Time Relations (cont.)

OBSERVING PROCESS MEASURE

Item	Score	Procedure	Instructions to the Child	Acceptable Response
2	a ____	The tester places card with black squares from 0-2 on the table in front of the child	Put your finger on the object which is different from the other two. (Allow about 15 seconds.)	The child should point to larger square (middle square).
	b ____	The tester points to the object selected by the child.	How is this one different from the others?	Child should verbally indicate that the square region he selected covers more area, or that it has longer sides, or that it is larger or bigger.
	T ____			
3	a ____	The tester holds card from 0-3 so that child cannot see the three squares of material on it.	I want you to feel with your fingers the three objects without looking on my side of this card. Tell me which one is different from the other two.	Should indicate the sandpaper square.
	b ____		In what way is it different	It is rougher, coarser, or not as smooth as the others.
	T ____			

Samples of Items from the "Process Instrument", Observing and Using Space/Time Relations (cont.)

OBSERVING PROCESS MEASURE

Item	Score	Procedure	Instructions to the Child	Acceptable Response
4 a	____	The tester places the three vials from 0-4 on the table in front of the child.	Pick up each of these three bottles. Put your finger on the one that is different from the other two.	The child should identify the lighter vial.
b	====	The tester points to vial selected by the child.	Why did you choose this one?	The child should indicate verbally that the object he selected was lighter than the other two.
T	____			

USING SPACE/TIME RELATIONS PROCESS MEASURE

Item	Score	Procedure	Instructions to the Child	Acceptable Response
1 a	____	The tester places the card containing the circular and elliptical shapes from S-1 on the table.	Which of these two shapes is a circle?	The child should point to the circle.
b	====	The tester points to the elliptical shape.	What shape is this?	Ellipse.
T	____			

Appendix K-4

Samples of Items from the "Process Instrument", Observing and Using Space/Time Relations (cont.)

USING SPACE/TIME RELATIONS PROCESS MEASURE

Item	Score	Procedure	Instructions to the Child	Acceptable Response
2 a	___	The tester places the wooden pyramid and cone from S-2 on the table.	Which of these two shapes is a cone?	The child should point to the cone.
b	___	The tester points to the pyramid.	What is this shape called?	Pyramid.
T	___			
3 a	___	The tester presents the child with the paper containing the pictures of the angles from S-3	What are figures like this called? (The tester should point to various angles.) (Allow 30 seconds each to respond to a, b, and c.)	Angles.
b	___		Point to an angle which is larger than a right angle.	The child should point to one of the obtuse angles.
c	___		Point to an angle which is smaller than a right angle.	The child should point to one of the acute angles.
T	___			

Samples of Items from the "Process Instrument", Observing and Using Space/Time Relations (cont.)

USING SPACE/TIME RELATIONS PROCESS MEASURE

Item	Score			
4	______	The tester places 10 paper clips from S-4 on the table in front of the child.	Make the outline of one rectangle using all of the paper clips. (Allow one minute.)	x x x x x x x x x x or x x x x x x x x x x

Directions for Teacher Questionnaire

INSTRUCTIONS FOR COMPLETING FSU-AAAS ELEMENTARY SCIENCE PROJECT EVALUATION QUESTIONNAIRE

The enclosed questionnaire is an important part of the evaluation for the special project to introduce "Science - A Process Approach" in Florida schools. Whether you have been involved in a formal instructional phase of the project or are a member of one of the other experimental groups, the information that we request in this questionnaire is of particular importance. Your cooperation in filling it out completely and according to the instructions provided will be very much appreciated. Although we ask that your name be included on the answer sheet, you may rest assured that the information you supply will not be made available in any form which might connect it with you individually. We intend to summarize the questionnaires according to the various treatment groups and no individual teacher will be indentified.

Because of the type of data analysis we must do, the questionnaire is of a closed-end type. This means that you are not given unlimited choices for responses. We are aware that some of the responses chosen may not seem particularly appropriate in your case and they may not give a clear picture of your feelings relative to certain points. This is a limitation dictated by the large number of questionnaires to be processed. We do solicit any particular comments you might have with regard to any portion of the questionnaire. Please feel free to write your comments on the enclosed blank sheet and mail it back as part of the package of materials.

You will note that since we are using machine scoring, we would like your questionnaire responses to be placed on the accompanying answer sheet. Would you please use appropriate spaces on the answer sheet to correspond with the item numbers on the questionnaire. Your response to the first item on the questionnaire should be placed in the appropriate box next to No. 1 on the answer sheet. Do not place responses in the identification number boxes. You will note that you work across the answer sheet. Please use a No. 2 lead pencil for marking on the answer sheet if possible and do do not make more than one mark for any particular response item. If you need to change an answer, please be certain to erase completely since the scoring machine will react to any extraneous pencil marks.

We would like you to fill in certain information at the top of the answer sheet and, since lines are not provided for all information, would you please place this information on any convenient lines at the top of the sheet. Please include:

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(1) YOUR NAME
(2) THE GRADE YOU TEACH
(3) YOUR TREATMENT GROUP
    Teachers who were in the 1965 Summer Institute are in Treatment Group 1, those who have been in the In-Service Institutes during the school year 1965-66 are in Treatment Group 2, those who have had the AAAS materials but no formal training are in Treatment Group 3, and those who have not been involved in the project at all except as a control are in Treatment Group 4.)
(4) YOUR HOME ADDRESS
(5) THE NAME OF YOUR SCHOOL
(6) SCHOOL ADDRESS

The other information requested at the top of the answer sheet may be left blank. You may find some marks on your answer sheet in the area referred to as "Identification Number." Most of those teachers in the in-service course group will not have such marks (identification number) on their answer sheets. If you are one of these teachers, your instructor will supply you with a number which should be written in after your name.

Please attempt to answer each question according to the way you feel about the particular item. It is possible that an item may not be appropriate for you and if this is the case you may feel free to leave it blank.

We would appreciate it if you would take the time to complete the questionnaire at your earliest possible convenience.

IMPORTANT: RESPONSE SHEETS CANNOT BE FOLDED. WOULD YOU THEREFORE PLEASE RETURN THEM TO US IN THE ENCLOSED ENVELOPE.

Thank you for your cooperation in this effort.

NDEA Proposal

SPECIAL PROJECT

Mr. Floyd T. Christian
State Superintendent of Public Instruction

TITLE: Implementation of AAAS Elementary Science Training Session

SUBMITTED BY: Division of Instructional Services

PRINCIPAL INVESTIGATOR: Dr. Earl Brakken, Assistant Professor
Department of Science Education, School of Education
Florida State University, Tallahassee, Florida

TRANSMITTED BY: Robert D. Binger, Consultant, Science Education

STATE FUNDS REQUESTED: $43,200.00

DURATION: Beginning Date November 1, 1965 Ending Date October 31, 196

DATE TRANSMITTED: October 1, 1965

Appendix M-2

SECTION I

I. PROBLEM: Action is needed because of an emergency situation which has arisen in our program of implementing training sessions for the AAAS Elementary Science Process Approach. The phasing out of FICUS and the transfer of their operations to the Board of Regents Office for Continuing Education has created a serious problem for Florida State University in that funds committed to the AAAS program by FICUS were not available to this program under the new operation. Consequently, Florida State, since they are fully committed and involved in contracted agreements to provide courses as well as conduct a research operation, must locate $43,200.00 for this purpose. The alternatives are limited to their absorbing it in some fashion through budgetary adjustments or receiving help through a Special Project.

The money is needed for the following purposes:

Adjunct Professor Salaries, 21 @ 1,600.00 =	$33,600.00
Assistants to Adjunct Professors Salaries, 21 @ 300.00 =	6,300.00
Travel for Adjunct Professors =	3,300.00
	$43,200.00

The money accruing from the $84.00 fee collected from the participants in the Continuing Education courses is now being used to defray expenses thus far entailed in the operation of the overall research and implementation operation for the period of January 1 through June 30, 1965 and miscellaneous expenses not covered by the USOE research grant from July 1, 1965 to October 1, 1965.

It should be noted that Florida State University did not originate this request. I took it upon myself to do this for several reasons, as follows:

1. this overall project was undertaken by Florida State University as a result of my persuading them to do so in order to improve the elementary science program.
2. as a result of this project, a group of resource people have now been trained to work with elementary teachers which puts us in a position we have never before enjoyed. The need extends beyond the benefits

of this effort however.

3. If Florida State University gets "stuck" for $43,200.00 after providing a service which we requested it appears to me that it will be a long time away on a mighty cold day before we can obtain any cooperation of a similar nature from them. While the political winds which blew this tempest our way were not of our brewing it seems to me that it will be to our advantage to absorb the main shock of the blow.

2. DESCRIPTION: This proposal provides for the salaries and travel expenses of 21 adjunct professors (now at work teaching classes) and their assistants. These people are junior college personnel and selected supervisory personnel and secondary science teachers who met the requirements for the teaching of courses with graduate credit. Their supervisors have adjusted the work load of these people to provide for this assignment.

It should be recalled that a prior grant was made from Special Project funds in January of 1965 to provide for the training of the above identified persons to teach elementary teachers how to use the AAAS Elementary Science Process Approach. This investment must be protected and its long range implementation assured as has been done in the case of modern mathematics.

SECTION II

1. PROCEDURES: (See Special Project Number 64-01-00

2. PERSONNEL:

Donald L. Abraham
Northeast High School
5500 16th Street North
St. Petersburg, Florida

Mr. William Bell
St. Petersburg Senior
High School
St. Petersburg, Florida

Mr. Floyd H. Clark
Science Coordinator
Board of Public Instruction
Sebring, Florida 33870

Mr. James W. Cooper
Spook Hill Elementary
Lake Wales, Florida

Appendix M-4

Mr. William N. Brown
Lake-Sumter Junior College
Leesburg, Florida

Mr. John Bullock
Robinson High School
6311 S. Lois Avenue
Tampa, Florida 33616

Mr. Harold G. Campbell
Miami-Dade Junior College
11380 N.W. 27th Avenue
Miami, Florida 33167

Mrs. Frances J. Jones
Westwood Junior High
1338 N.W. 91st Terrace
Gainesville, Florida

Mr. Michael T. Kambour
Miami-Dade Junior College
11380 N.W. 27th Avenue
Miami, Florida 33167

Mr. Edmund J. Leddy, Jr.
Miami-Dade Junior College
11380 N. W. 27th Avenue
Miami, Florida 33167

Mr. Carl E. Martin
Pompano Beach Senior High
1400 N. E. Sixth Street
Pompano Beach, Florida

Mr. Roger Mott
Science Coordinator
Board of Public Instruction
215 West Garden Street
Pensacola, Florida 32502

Miss Betsy A. Conlon
Madison Junior High
Tampa, Florida

Mr. James B. Fleek
Associate Professor
Jacksonville University
Jacksonville, Florida

Mr. Jon Fortman
Maynard Evans High School
4949 Silver Star Road
Orlando, Florida

Mr. Hans Schneider
Eau Gallie High School
1400 Stewart Road
Eau Gallie, Florida

Mr. Don Self
Director of Instruction
Board of Public Instruction
4850 Lords Avenue
Sarasota, Florida 33581

Miss Bernice C. Shor
Rollins College
Winter Park, Florida 32791

Mr. Robert Westbrook
Science Coordinator
Board of Public Instruction
Post Office Box 2469
West Palm Beach, Florida 33420

Miss Janet Whitman
Sarasota High School
Sarasota, Florida

Mr. John D. Woolever
Science Coordinator
Board of Public Instruction
Sarasota, Florida 33581

3. FACILITIES: Junior College and high school laboratories are being used in various centers around the state.

Appendix M-5

SECTION III

(See Special Project Number 64-01-00)

SECTION IV

1. PROPOSED BUDGET:

A. Special Project Funds

Adjunct Professor salaries
21 @ 1,600.00 = $33,600.00
Assistants to Adjunct Professors
salaries 21 @ 300.00 = 6,300.00
Travel for Adjunct Professors = 3,300.00
43,200.00

Florida State University Support:

Various contributions and grants, Money from U.S.O.E. as outlined in attached proposal (copy also attached to Special Project Number 64-01-00

B. Investigator: Dr. Earl Brakken

Beginning Date November 1, 1965 Ending Date October 31, 1966

C. Institution: Florida State University

NDEA Project Final Report

MEMORANDUM May 30, 1966

TO: Dr. Robert Gates
Coordinator
National Defense Education Act

FROM: Earl W. Brakken
Director
FSU-AAAS Elementary Science Project

SUBJECT: Final Report For Project #66-74-07

A grant of $43,200 (Special Project #66-74-07) was awarded to the Florida State University for the purpose of supporting instructional personnel for twenty-one special in-service course sections. The twenty-one sections of Science Education 509 were offered to introduce elementary teachers to a new curriculum in science for grades K-3. Five hundred Florida teachers were enrolled in this course which was set up as part of a USOE-supported research project designed to study most effective means for dissemination of an educational innovation to large numbers of teachers.

Teachers have indicated almost unanimous approval of both the instructional program and the use of the new teaching approach. Favorable reactions have been received from parents as well. Perhaps the most striking testimonal to the effectiveness of the instructional program has been the large number of requests initiated for continuation and extension of the project for the school year 1966-67.

The status of the project is as follows:

1. Meetings were initiated during the second week of the school year 1965-66 at each of the twenty-one centers. Thirty-one weekly meetings of three hours in duration were held at each center and instruction has now been completed.

2. Approximately five hundred teachers were enrolled in the course for graduate credit. Participating teachers, all of whom employed the new curriculum in their own teaching situations, received six semester hours of graduate credit for successful completion of the course.

NDEA Project Final Report (continued)

Page 2

Funds allocated by NDEA Special Projects were expended as follows:

1.	Instructors' Salaries ---------------------- (21 instructors @ $1600 each)	$33,600
2.	Assistants' Salaries ---------------------- (21 assistants @ $300 each)	$ 6,300
3.	Travel and Incidental Expenses ------------	$ 3,300

Below is a list of the centers for the twenty-one course sections with instructors and assistants.

Center	Instructor	Assistant
Belle Glade	Mr. Robert Westbrook	Mrs. Mercedes Robinson
Bradenton	Mr. James Don Self	Mr. William Aldrich
Clearwater	Mr. William A. Bell	Mrs. Jane Fels
Cocoa	Mr. Jon R. Fortman	Mr. Gordon Crouch
Gainesville	Mrs. Francis Jones	Mr. Richard Dillard
Hialeah	Mr. Harold Campbell	Mrs. Harriett Ehrhard
Jacksonville	Mr. James B. Fleek	Mr. James Scroggins
Lake Wales	Mr. James Cooper	Miss Evelyn Hughes
Lake Worth	Mr. Carl E. Martin	Mr. Paul H. Gebert
Leesburg	Mr. William N. Brown	Mr. Ned R. Richardson
Melbourne	Mr. Hans Schneider	Mr. Earl Benton
Miami North	Mr. Edmund Leddy	Mr. Stewart Darrow
Miami South	Mr. Michael T. Kambour	Mr. Howard Winniman
Naples	Mr. John Bullock	Mrs. Paula Odom
Orlando	Miss Bernice Shor	Mrs. Nancy Connell
Pensacola	Mr. Roger C. Mott	Mr. Donald B. Hand
Punta Gorda	Mr. Floyd H. Clark	Mr. John A. Peel
St. Petersburg	Mr. Donald L. Abraham	Mr. William E. Beggs
Sarasota	Mr. John D. Woolever	Miss Jeanette Matheson
Sarasota-Bradenton	Miss Janet Whitman	Mr. Joseph Barone
Tampa	Miss Betsy A. Conlon	Mrs. Dorothy Gregory

This is the final report for the project.

EWB/rlm

bcc: Mr. Joseph Smith
Mr. Philip Rordyce
Dr. J. Stanley Marshall
Mr. Worth Scanlan

First Technical Progress Report on USOE Project

Cooperative Research Project No. 5-0651-2-10-1
Contract OE-6-10-046

Period covered by report: July 1, 1965, to March 1, 1966

Name of institution:	Florida State University (Tallahassee, Florida)
Title of project:	"A Comparison of Various Techniques to Disseminate a New Science Curriculum in Florida"

Names of project directors:

Dr. Earl W. Brakken
Department of Science Education
Florida State University

Dr. Ernest Burkman
Department of Science Education
Florida State University

I. Major activities during this reporting period:

A. A summer workshop to train instructors for teaching Science Education 509 was held from June 14 through July 16, 1965.

B. A summer institute to train thirty elementary teachers to utilize "Science - A Process Approach" in their own classrooms was held from June 14 through July 16, 1965.

C. An in-service course, Science Education 509 (Se En 509), was developed.

D. Twenty-one sections of the in-service course for elementary teachers (Se En 509) have been initiated at sites throughout the state and are currently in progress.

E. Thirty teachers have been selected from the in-service group to serve as the research sample representing this group.

F. Materials have been distributed to forty elementary teachers in the state of Florida. These teachers are using the materials with no further orientation and serve as the "materials only group" in the research design.

G. Thirty teachers within the state of Florida have been identified and have agreed to participate as control teachers in the experimental design.

H. There has been close supervision, including several visitations, for each in-service course section and for the various other aspects of the project.

I. Base-line tests have been given to all students of teachers sampled from the various treatment groups. The Metropolitan Reading Readiness Test has been administered to all first grade students and the California Test of Mental Maturity to all second and third grade students. These tests have been scored and are currently being analyzed.

J. A staff of supervisors has been trained to administer a specially developed activity check list (based on the technique recently popularized as interaction analysis). This training took place in Clearwater, Florida, during the weekend of January 8.

K. The supervisory staff mentioned in J are currently observing classes and utilizing the activity check list as a basis for their observations. Results of these observations are being tallied and analyzed.

L. Preliminary testing has been done on a pilot basis using the Process Measure developed by AAAS personnel. The Process Measure is being revised, based on results of pilot testing, and put into final form. This instrument will be administered to a sample of students from each of the various treatment groups in May, 1966.

M. All teachers in the various treatment groups have been provided with kits of materials appropriate to teach the Process Approach. These include both the laboratory activity materials and the written materials designed to accompany the course.

N. Testers are currently being hired to administer the Process Measure individually to the pupil sample from the various treatment groups.

(All of the activities mentioned above have been conducted with U. S. Office of Education support. Prior to initiation of the activities reported above, considerable organization and communication to educators throughout the state of Florida was accomplished. Included among these activities were a series of thirty meetings held by the Director and other personnel to introduce the project and to recruit teachers for the various treatment groups. This part of the project was supported by local and state funds.)

II. Future activities planned for next reporting period:

A. Instruction in the in-service institutes will be completed by May 15, 1966.

B. Observations of sampled teachers in the various treatment groups will be accomplished by use of the activity check list. This activity will be completed by June 1, 1966.

C. A series of seven meetings will be held around the state to train the testing personnel who will administer the Process Measure.

D. Testing of a sample of students from the various treatment groups with the individually administered Process Measure will be accomplished between May 1 and May 15, 1966, by the corps of testers yet to be selected.

E. A questionnaire will be prepared and distributed to all teachers in the project including all teachers participating in the twenty-one institutes to evaluate:

(1 (1) the relative effectiveness of the dissemination technique;

(2) the attitudes of teachers toward the use of the "Process Approach" materials;

(3) the attitudes of teachers toward the general program of science curriculum improvement.

F. Data will be analyzed and interpreted. This will include results of observation by supervisors, results of the Process Measure tests for children, and results of the teacher questionnaire. Also to be summarized will be the administrative aspects of the total project. Such things as costs of the various dissemination techniques and relative efficiency of each method will be analyzed and described. The research report will be completed and submitted by October 1, 1966.

III. Special problems and major departures from Appendix A:

None

IV. Report on compliance with Article 8 of the contract:

Compliance has been met with Article 8 (no questionnaires were used in soliciting personnel to work for this project). A questionnaire will be designed to solicit from teachers information concerning the outcome of the project. However, this questionnaire will be utilized on a non-discriminatory basis and will not relate in any way to employment or participation of personnel in this project.

V. Staff summary:

Name	Title	Per Cent of Time Devoted To Project
Dr. Frank Banghart	Project Director	10
Dr. Earl W. Brakken	Project Director	100
Dr. Ernest Burkman	Project Co-Director	10
Mr. Phillip Fordyce	Project Co-Director	100
Dr. David Redfield	Research Associate	50
Mr. James Pierce	Instructor, Summer Institute	100
"	Research Assistant	50
Mrs. Dorothy Webb	Administrative Assistant	100
Mr. John Bonar	Administrative Assistant	25
Mrs. Esther Leedham	Instructor, Summer Workshop	100
Mr. Harold Jaus	Laboratory Assistant	100
Miss Illa Podendorf	Consultant	100
Dr. Henry Walbesser	Consultant	100
Dr. Edwin Kurtz	Consultant	100
Mr. Garland Allen	Consultant	100
Mrs. Cecile Williams	Secretary	100
Mrs. Frances Guerin	Secretary	100
Miss Ann Keith	Secretary	100
Mrs. Elise Bryant	Secretary	100
Mrs. Raymona Mulford	Clerk-Typist	100
Mr. Dudley Herron	Graduate Assistant	100
Mr. Theodore Kellogg	Graduate Assistant	100
Mr. Robert Pooley	Graduate Assistant	100

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Name	Title	Per Cent of Time Devoted To Project
Miss Eloise Mann	Graduate Assistant	100
Mr. Daniel Kaufmann	Graduate Assistant	100
Mr. Donald Abraham	Instructor, In-Service Institute	Local funds: 25
Mr. William Bell	"	"
Mr. William Brown	"	"
Mr. John Bullock	"	"
Mr. Harold Campbell	"	"
Mr. Floyd Clark	"	"
Miss Betsy Conlon	"	"
Mr. Hans Schneider	"	"
Mr. James Cooper	"	"
Mr. James Fleek	"	"
Mr. Jon Fortman	"	"
Mrs. Francis Jones	"	"
Mr. Michael Kambour	"	"
Mr. Edward Leddy, Jr.	"	"
Mr. Carl Martin	"	"
Mr. Roger Mott	"	"
Mr. James Don Self	"	"
Miss Bernice Shor	"	"
Mr. Robert Westbrook	"	"
Miss Janet Whitman	"	"
Mr. John Woolever	"	"
Mr. Joseph Barone	Assistant Instructor, In-Service Institute	Local funds: 10
Mr. Earl Benton	"	"
Mr. Richard Dillard	"	"
Mr. Stewart Darrow	"	"
Mrs. Harriett Ehrhard	"	"
Mr. Paul Gebert	"	"
Mrs. Dorothy Gregory	"	"
Mr. Donald Hand	"	"
Miss Evelyn Hughes	"	"
Mrs. Paula Odom	"	"
Mr. John Peel	"	"
Mr. Ned Richardson	"	"
Mrs. Mercedes Robinson	"	"
Mr. Howard Winniman	"	"
Mr. William Aldrich	Assistant Instructor-Evaluator, In-Service Institute	Local funds: 10 USOE funds: 15
Mr. William Beggs	"	"
Mrs. Nancy Connell	"	"
Mr. Gordon Crouch	"	"
Mrs. Jane Fels	"	"

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Name

Name	Title	Per Cent of Time Devoted To Project
Miss Jeanette Matheson	Assistant Instructor-Evaluator, In-Service Institute	Local funds: 10 USOE funds: 15
Mr. James Scroggins	"	"
Dr. Boyd Ayers	Evaluator	15
Mrs. Bobbie Hathorn	"	"
Mr. Charles Hathorn	"	"
Mrs. Evelyn Stack	"	"
Mr. Buford Robinson	"	"

VI. Date: March 1, 1966

VII. Signature of the Project Director

Earl W. Brakken

Appendix P-1

Second Technical Progress Report on USOE Project

Cooperative Research Project No. 5-0651-2-10-1
Contract OE-6-10-046

Period covered by report: March 1, 1966, to October 1, 1966

Name of institution: Florida State University
(Tallahassee, Florida)

Title of project: "A Comparison of Various Techniques to Disseminate a New Science Curriculum in Florida"

Names of project directors:

A. During period reported upon

Dr. Earl W. Brakken
Department of Science Education
Florida State University
Tallahassee, Florida

Present address:
Dr. Earl W. Brakken
Director
Research and Development
Glenbard Public Schools
Glenbard West High School
Glen Ellyn, Illinois

Dr. Ernest Burkman
Department of Science Education
Florida State University
Tallahassee, Florida

Present address:
Dr. Ernest Burkman
Director
Junior High School Science Curriculum Project
Florida State University
Tallahassee, Florida

Mr. Phillip R. Fordyce
Department of Science Education
Florida State University
Tallahassee, Florida

Present address:
Mr. Phillip R. Fordyce
Assistant Dean
School of Education
Florida State University
Tallahassee, Florida

B. Present

Dr. Paul Westmeyer, Professor and Head
Department of Science Education
Florida State University
Tallahassee, Florida

Mr. Phillip R. Fordyce, Assistant Dean
School of Education
Florida State University
Tallahassee, Florida

I. Major activities prior to USOE support:

  A. Organization of project and sending of communications to teachers who were prospective participants.

  B. Series of thirty meetings for recruitment of teachers.

II. Major activities from July 1, 1965, to March 1, 1966:

  A. Workshop to train instructors for SeEn 509.

  B. Summer institute to train thirty elementary teachers in "Science - A Process Approach," treatment number 1.

  C. Development of materials for in-service course, SeEn 509.

  D. Identification of twenty-one areas of the state in which SeEn 509 was to be offered.

  E. Selection of thirty teachers from the in-service group to serve as treatment number 2.

  F. Selection of forty elementary teachers in Florida to serve as treatment number 3. (These teachers were provided with AAAS materials but with no instruction or orientation to the course.)

  G. Identification of thirty teachers in Florida to serve as controls in the experiment.

  H. Visits by staff members to each in-service course.

  I. Administration of tests: Metropolitan Reading Readiness (first grade students), California Test of Mental Maturity (second and third grade students).

  J. Training of observers to administer "Interaction Analysis" Instrument.

  K. Observations by staff personnel of teachers in the classroom.

  L. Pilot testing and revision of the "Process Measure" developed by AAAS.

  M. Selection and preparation of field workers to administer the "Process Measure."

  N. Provision of kits of materials for AAAS course to teachers in the three treatment groups.

III. Major activities from March 1, 1966, to October 1, 1966:

  A. Completion of instruction in in-service institutes (May 15, 1966).

  B. Observations of teachers by staff members using "Interaction Analysis" instrument (June 1, 1966). *

  C. Completion of instruction of testing personnel administering "Process Measure" of AAAS (May 1, 1966).

  D. Completion of testing of students in the four treatment groups using "Process Measure" (May 15, 1966). *

  E. Design of questionnaire to be distributed to teachers in the four groups (May 1, 1966).

  F. Administration of questionnaire (June 1, 1966).

  G. Preliminary analysis of data.

    1. Tabulation of results of teacher questionnaire (August 1, 1966).

    2. Preliminary analysis of results of "Process Measure" (August 1, 1966).

    3. Preparation of computer program and preliminary analysis of results of observations using "Interaction Analysis" instrument (August 1, 1966).

  H. Meeting of in-service institute instructors and project staff members for verbal analysis of results (September 18, 1966).

IV. Major activities planned for rest of project:

  A. Redesign of computer program and reanalysis of results from administration of "Interaction Analysis" instrument.

  B. Statistical analysis of results of testing using "Process Measure."

  C. Review of tabulation of questionnaire results.

  D. Summarization of administrative aspects of total project.

  E. Interpretation of results obtained by analyses listed in A, B, and C.

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* Exception, one instance mentioned later under Section V.

F. Preparation of final report. (This will be the primary responsibility of the present directors, Dr. Paul Westmeyer and Mr. Phillip Fordyce, who will prepare the report in consultation with Dr. Earl W. Brakken, former project director, and consultants listed later in this interim report. This report will be completed and submitted by March 31, 1967.)

V. Special problems and major departures from original proposal:

A. As referred to in footnote, one set of data from the observation using "Interaction Analysis" instrument has not yet been completely reported upon. We are presently attempting to collect this set of data; however, if it remains unavailable, analysis of data in hand is quite possible. This will reduce by one school the sample in treatment number 3.

B. Directorships have had to be changed due to the moving of staff within the School of Education at Florida State University and also due to the resignation of Dr. Earl Brakken.

C. An extension of time for completion of analysis of data and preparation of the report of this project has been requested, and granted, until March 31, 1967.

VI. Report on compliance with Article 8 of the contract:

Compliance has been met with Article 8 (no questionnaire was used in soliciting personnel to work for this project). A questionnaire was designed and used to solicit from teachers information concerning the outcome of the project. This questionnaire was used on a non-discriminatory basis and did not relate in any way to employment or participation of personnel in project.

VII. Staff summary:

A. As listed in technical report covering period July 1, 1965, to March 1, 1966.

B.

Name	Title	Per Cent of Time Devoted To Project
Dr. Paul Westmeyer	Project Co-Director	25
Mr. Phillip Fordyce	Project Co-Director	100
Miss Ann Keith	Secretary	50
Mrs. Linda Thompson	Secretary	50
Consultants		
Mr. Jack Hopper		
Mr. James Van Pierce		

Miss Betsy Conlon
Dr. William S. LaShier, Jr.
Mr. Bruce C. Watt
Mr. Darrell Phillips
Dr. Earl W. Brakken

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VIII. Date: October 1, 1966

IX. Signature of Project Director

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Paul Westmeyer